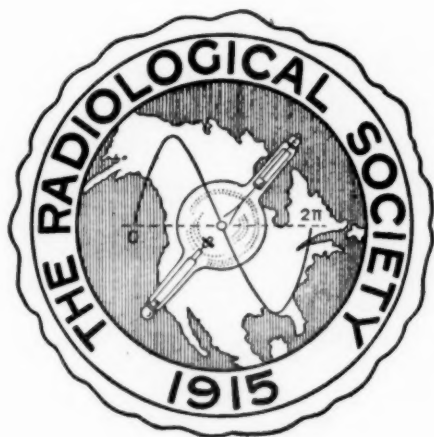


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No. 1



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The JOURNAL OF RADIOLOGY

Omaha, Nebraska

VOL. IV

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Bone Cysts (Ostitis Fibrosa): Variety---Polycystic Ostitis Fibrosa

An Inflammatory Lesion of the Marrow Tissue of the Shaft of Bones
Before Ossification of the Epiphysis

JOSEPH COLT BLOODGOOD, M. D.
Baltimore, Maryland

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I WISH to report in this paper five cases which differ from the ordinary bone cyst in the gross and microscopic pictures of the inflammatory tissue filling the bone shell. The term *polycystic ostitis fibrosa* seems descriptive.

BRIEF SUMMARY OF THE CASES

Case 1—(Pathol. No. 11466)—Operation by Dr. L. W. Hotchkiss at Bellevue Hospital, New York, December, 1910. Lesion in lower end of tibia involving the epiphysis. White male, aged 23; duration of swelling, four years; operation, curetting; ultimate result not ascertained. (See Figs. 1 to 8). Some pathologists might look upon this case as hemangioma cavernosum of bone.

Case 2—(Pathol. No. 12838)—Operation by Dr. William Baer at the Church Home Hospital, Baltimore, May, 1912. The tumor involved the spine of a dorsal vertebra in a white male aged 17. The symptom, pain, had been present seven months. The tumor was partially removed. This patient is well (1922) ten years after observation. (See Figs. 9 and 10).

Case 3—(Pathol. No. 12378)—Operation by Dr. S. T. Mixter of Boston in April, 1910. The lesion involved the crest of the ilium, which was partially removed. The patient has been well (1922) twelve years with

exostoses in the area of the old lesion which give no symptoms. (See Figs. 11, 12 and 13).

Case 4—(Pathol. No. 25892)—Operation was performed by Dr. James M. Hitzrot of New York, January, 1916, and was reported by him with illustrations in the *Annals of Surgery*.⁽¹⁾ The lesion involved the upper third of the shaft of the humerus and was diagnosed by Drs. Elser and Ewing as hemangioma cavernosum. The operation consisted of partial excision without destruction of the continuity of the shaft. (See Figs. 14 and 15). I saw this patient in December, 1920, because of recurrence of pain and loss of function. Nothing was done, and the patient is well (1922) six years after the original operation.

In these four cases there was but one focus found.

Case 5—(Pathol. No. 29834)—Operation by Dr. Ghormley in Dr. Baer's orthopedic service, Johns Hopkins Hospital, March, 1922.

In this case the lesions were multiple, in the lower end of the tibia and fibula and in the metatarsal bone of the great toe of the left foot. At the operation the lesion in the metatarsal only was curetted. (See Figs. 16 and 17).

CLINICAL PICTURE OF BONE CYSTS

Group 1: The majority of cases are under 15 years of age. If older than 18 the symptom of onset, as a rule, dates back to a period younger than 18. Von Mikulicz was the first to emphasize the fact that the benign bone cyst is a disease of the juvenile bone. In more than 50 per cent of the cases the young individual experiences no pain and observes no swelling or loss of function, until, after a trauma producing fracture, an x-ray is taken and the central lesion revealed. Now and then there is a case having a history of a healed fracture of which no x-ray was taken at the time of the injury, but after the occurrence of a second fracture an x-ray brings the first lesion to

view. In a few cases there have been repeated fractures with healing, without x-ray examinations, until finally, after a recurrent fracture or swelling, the diagnostic x-ray is made.

Therefore, in the larger number of bone cysts fracture is the symptom of onset.

Group 2: In a smaller number of cases within the same age limits as in the first group there is no history of fracture, and the patient comes under observation and x-ray because of an observed swelling or expansion of the shaft of a long bone, usually near the epiphysis. Such cases are usually located in the upper end of the tibia, in the radius and ulna, or the fibula.

Group 3: In groups one and two the history and the examination find but one focus. In a very few of these, x-rays of the entire skeleton may reveal another small cyst involving a second bone.

Group 4: The clinical picture is that of multiple lesions of bone, often with the history of repeated fractures in one bone after another; these heal. Or there may be multiple swellings without fracture. The x-ray makes the diagnosis, as in groups one and two.

Group 5: Here so many bones are involved that we must look upon it as a disease of the entire skeleton. This group is infrequent. It was first described by von Recklinghausen as *ostitis fibrosa* of the entire skeleton. I have reviewed the literature of this group in 1910⁽²⁾ and there is a recent article by John L. Morton.⁽¹⁷⁾

Group 6: Bending or bowing of a single bone may be the symptom of onset; later there may be fracture. Kammerer of New York was first to describe such a case.

Group 7: When the patient comes under observation there may be but a single huge swelling or expansion of the involved area, the symptom of onset, swelling, dating back to the age of adolescence. I have described and

*—Received for Publication September 26, 1922.



Fig. 1—Case 1—Pathol. No. 11466—X-ray before operation. Polycystic ostitis fibrosa.

Fig. 2—Case 1—Pathol. No. 11466—X-ray before operation. Polycystic ostitis fibrosa.

illustrated these in the *Annals of Surgery*.⁽²⁾

Group 8: Here is found the latent or unhealed bone cyst, observed in adult life. Recently a number of adults have come under my observation who, because of a recent trauma or pain in a bone, have had x-rays taken, and a central lesion of the bone brought for the first time to the light. This group I have discussed in *Minnesota Medicine*.⁽³⁾

Group 9: In two instances the clinical picture of the bone cyst near a joint has been obscured by infection and the symptoms suggested arthritis or osteomyelitis.

Group 10: In one instance the bone cyst had completely ossified, but the swelling had not disappeared twenty years after its first appearance.⁽⁴⁾

Age, therefore, is the greatest help in the diagnosis of a bone cyst, if the patient is under 15. After that the age is not helpful.

Fracture as a symptom of onset is very suggestive of the bone cyst, and so is bending, but both, especially fracture, are observed in every type of central bone lesion.

Pain: In bone cysts pain is not a prominent symptom, except when there is a recent fracture, when it may be intense until the fracture is fixed. The presence or absence of pain, therefore, is not of diagnostic value.

Tenderness: This is rarely present, except with recent fracture.

In central sarcoma, in multiple myeloma and in metastatic carcinoma of

bone, pain and tenderness are more frequently observed than in the bone cyst or in the central giant-cell tumor.

Loss of Function: This is never present, except with fracture, or when the cyst is near the joint, especially in the head of the femur, when the bone ex-



Fig. 3—Case 1—Pathol. No. 11466—Painting made from original tissue removed from the bone cavity shown in Figs. 1 and 2. Some of the cavities contained blood clot.

pansion may interfere with function.

Palpation: When the x-ray shows an intact bone shell, the soft parts outside of the bone on palpation feel as normal tissue. In the two cases in which

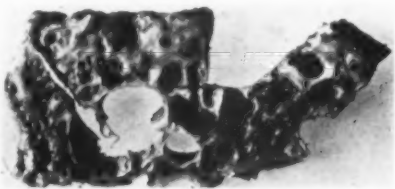


Fig. 4—Case 1—Pathol. No. 11466—Photograph of gross specimen removed from the bone cavity shown Figs. 1 and 2. Typical picture of polycystic ostitis fibrosa.

the cyst was infected this was not so; here the soft parts were infiltrated.

In the majority of cases of bone cysts the expanded area feels like bone. Now and then the shell may be so thin that parchment crepitation is made out, or there may be places where the bone shell is absent. In a few instances a definite perforation could be palpated. Pulsation has never been noted. If fracture is present, there may be crepitation.

There is nothing of diagnostic value in the palpation of the shell of bone covering a bone cyst, as compared with palpation in the giant-cell tumor, the central myxoma and chondroma, the sarcoma, multiple myeloma and metastatic carcinoma. It is true that definite parchment crepitation is more often observed in the benign bone cyst.

When one can see in the x-ray a central tumor with an intact bone shell and then can palpate in the soft parts outside the shell a definite tumor or a definite infiltration, this indicates either a sarcoma, an infected bone cyst, tuberculosis or a Brodie abscess.

The chapter, however, on palpation of the soft parts about a central bone lesion with intact bone shell cannot be written until we have more accurate records, and I take this opportunity to urge clinicians and roentgenologists not only to palpate carefully, but to make a clear record of what they feel.

I can find nothing characteristic in the different types and shapes of the expansion of the bone shell. It may be gradual or abrupt; it may be smooth or irregular; it may be present on all sides, or on only one side of the bone involved, in the different types of central bone lesions.

Multiplicity: The demonstration in the x-ray of multiple central lesions excludes primary sarcoma. The patient with multiple myeloma or metastatic hypernephroma as a rule has Bence-Jones bodies in the urine, is an adult, and shows definite symptoms of cachexia. In the multiple metastatic carcinoma the patient is an adult and as a rule there is a history, or evidence, of a primary tumor elsewhere. In younger individuals, in a few instances, the multiple central tumors have proved to be chondromas.

X-RAY OF BONE CYSTS

Since 1899 I have followed the literature on the x-ray diagnosis of a single, central tumor with an intact bone shell, and I have never been willing to accept the definite conclusion of some authorities that the x-ray picture of a bone cyst was characteristic; and now that my experience is very much larger I am still unable to furnish any evidence that the different types of central bone lesions have anything characteristic in

the x-ray picture. It is true, the localization of the lesion is helpful. The bone cyst rarely extends into the epiphysis through the epiphyseal line, while the giant-cell tumor and central sarcoma usually do. But there are exceptions in both. (Note—The x-ray of metastatic hypernephroma is beginning to seem characteristic).

Perforation of the Shell: In many reports received from roentgenologists, when perforation of the shell could be made out in the x-ray, this was looked upon as suggestive of malignancy, or even pathognomonic. But the older literature which I have reported in *Progressive Medicine* from time to time, records numerous instances of perforation in the benign bone cyst. True, these were older cases, but I have observed it in small cysts of recent origin.

Partial or Complete Destruction of the Bone Shell: It is true that this is more frequent in the giant-cell tumor, in sarcoma, myeloma, metastatic tumor and in myxoma, but it may be observed in the bone cyst.

Evidence of New Periosteal Bone Formation Outside the Bone Shell Not to be Explained by Fracture: This is most frequently observed in sarcoma. So far I have never observed it in the giant-cell tumor, and I thought it never occurred in the bone cyst, until recently Dr. Codman showed me a case of multiple bone cysts in which new periosteal bone formation could be seen in the x-ray outside the bone shell of one of the cysts.

Perhaps a larger number of cases and a more critical study of the x-rays may bring to light some pathognomonic changes in the central bone tumors, but at present my experience warns me not to rely too implicitly on the x-ray picture only. This point has been discussed, with illustrations, in *Minnesota Medicine*.⁽³⁾

Healing of Fracture: This is not diagnostic. It has been observed in every type of central bone lesion.

GROSS PATHOLOGY OF BONE CYSTS

In the *Annals of Surgery*⁽²⁾ and in the *Transactions of the American Surgical Association*⁽⁵⁾ for 1910 I classified the gross findings, on opening the bone shell, into six main groups, with illustrations.

Group 1: Cutting down upon the bone shell reveals no change in the soft parts. On stripping back the apparently normal periosteum the surface of the bone is not white, with pin-point hemorrhages from the Haversian canals, but dark, like the bark of a tree, and there is no hemorrhage. On removing the shell of bone there is found to exude, under no pressure, a viscid, serous fluid, sometimes slightly brownish stained. In my experience this fluid has never been bloody. But if there has been a recent fracture there may be a small blood clot or two. When one cures the bone shell, there is no connective tissue lining. Now and then one may find in a little recess some friable, red granulation tissue which in the gross, resembles the giant-cell tumor, and under the microscope, contains giant cells.⁽⁶⁾ When one makes a section of the bone shell, the Haversian canals are filled with a fibrous cellular connective tissue, abnormal for bone, but histologically identical with the connective-tissue lining of Group 2.

I know of no other bone lesion which has a gross picture similar to this.

Group 2 When the bone shell is removed one comes in contact with a definite connective tissue of the consistency of leather. It varies in thickness from a few millimeters to a centimeter or more. On perforating this connective tissue lining the same type of fluid as in Group 1 is encountered. In a few instances I have observed on the inner surface of the connective tissue

lining a covering of snow-white granular material of calcium salts.

Pathol. No. 19179, in a previous number of the Journal,⁽⁷⁾ beautifully illustrates this connective tissue lining within the bone shell, but the case was incorrectly diagnosed a malignant bone cyst. The x-ray of the bone cyst shown in Figure 2 of the same issue of the Journal had a similar connective tissue lining. Now that I have restudied and rediagnosed Pathol. No. 19179 I can state that sarcoma occurring as a bone cyst never has this leathery connective tissue lining.

Group 3: The connective tissue lining is so thick that there remains but a single small cyst, or a few multiple cavities (*polycystic otitis fibrosa*). Figure 6 in the *Annals of Surgery* for August, 1910, pictures such a case with a single small cyst, and Figures 3 and 4 in this paper show a polycystic type. I have never observed sarcoma to have this gross appearance.

Group 4: Solid Ostitis Fibrosa. The bone shell is completely filled with a leathery, white connective tissue, pictured in Figure 8 in the *Annals of Surgery* for August, 1910. Figures 32 and 89 in the *Journal of Radiology* for March, 1920, belong to this type. Their gross and microscopic pathology has been illustrated in the *Southern Medical Journal*.⁽⁸⁾ This small group of solid otitis fibrosa has been mistaken in the gross and in the section for sarcoma.⁽⁹⁾

Codman of Boston in his registration of bone sarcomas finds a few examples of this type reported to him as cases cured after amputation.

This Group 4, solid otitis fibrosa, is therefore a very important one to be critically and repeatedly studied by pathologists and surgeons in order to avoid an unnecessary resection or amputation for this benign lesion. I reported and illustrated in the *Journal of Radi-*

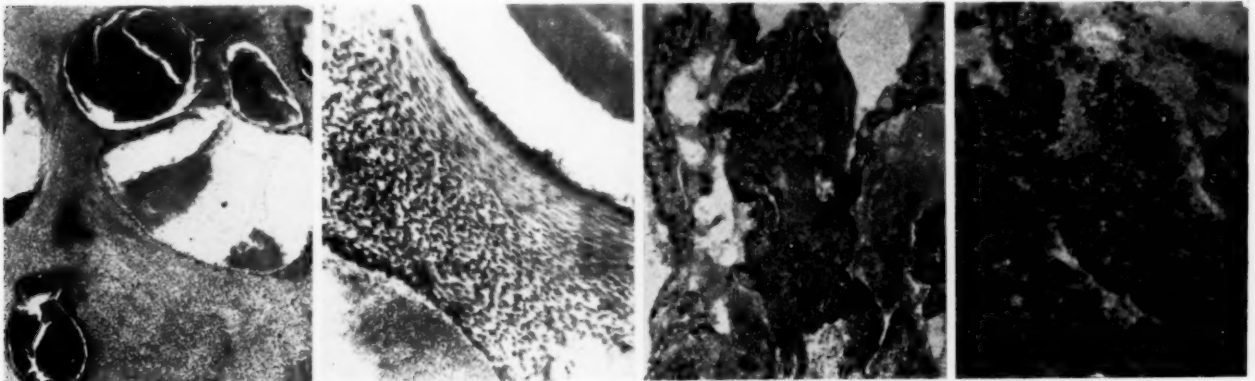


Fig. 5—Case 1—Pathol. No. 11466—Microscopic picture (low power) showing cysts filled with blood and debris with many osteoblasts in the wall of the cysts. For high power see Fig. 6.

Fig. 6—Case 1—Pathol. No. 11466—Microscopic picture (high power) of area shown in Fig. 5. Shows fibrous and cellular areas of otitis fibrosa, a giant cell, and

near the cyst, numerous osteoblasts.

Fig. 7—Case 1—Pathol. No. 11466—Microscopic picture showing the smaller cyst and numerous osteoblasts in a cellular otitis-fibrosa tissue.

Fig. 8—Case 1—Pathol. No. 11466—High power picture of a cellular area with numerous giant cells, not unlike the picture of the giant-cell tumor.

ology⁽¹⁰⁾ a type of central fibrosarcoma resembling somewhat in the gross and in the section solid ostitis fibrosa.

Group 5: Multilocular Cysts. These are observed chiefly in the huge bone cysts. But this group I now place with Group 3, polycystic ostitis fibrosa.

Group 6: In the *Annals of Surgery*⁽²⁾ I placed in this group a number of miscellaneous cases: A, infected bone cyst; B, x-ray studies only, no operation. This group, 6-B, has increased from five cases in 1910, to seven in 1922; C, autopsy specimens, all of the huge type, and as nothing was preserved but the bone shell, a classification as to connective tissue lining could not be made; D, healed bone cyst. Here, on exploration the area within the bone shell has completely ossified.

With the exception of Group 4, solid ostitis fibrosa, there should be no difficulty in recognizing the different gross types of the benign bone cyst when the bone shell is removed.

HEALING OF THE BONE CYST

This will receive but brief mention here. I have discussed it in the *Southern Medical Journal*.⁽⁸⁾

We now have a number of cases in which a diagnosis of a bone cyst has been made from the x-ray. The patients have been followed, there has been no fracture, except the original one, if any, and ossification has finally taken place. There seems no doubt that the tendency of the inflammatory lesion, whatever its cause, is finally to ossify, and the bone is finally restored to almost normal.

I now have record of the ultimate results in practically every case, whether operated on or not, and in the majority of cases an x-ray of the permanent result. In a few the bone is restored to absolutely normal; a few show bending; a few show unhealed light areas. This study of the healing of the bone cyst brings out one fact very clearly. If there is a fracture, with few excep-

tions, complete healing will take place. I observed one bone cyst of the femur for a period of fifteen months. During this time it showed but slight ossification; a fracture took place, and there was complete ossification in six weeks.

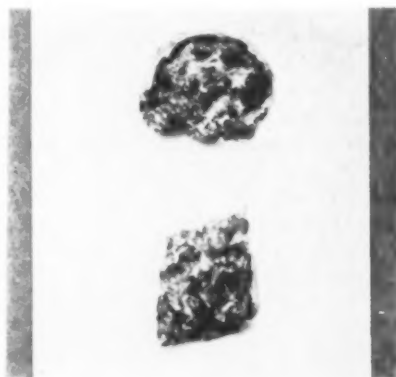


Fig. 9—Case 2—Pathol. No. 12838—Polycystic ostitis fibrosa in spinous process of vertebra. Photograph of two of the pieces removed at operation. Note the thin bone shell and the minute cystic cavity in the tissue beneath.

I have used this as an indication for operation: If the patient is under 15, and there is a fracture, do not operate; the x-ray pictures will undoubtedly, later on, picture the ossification. If there is no fracture and the x-ray shows little or no ossification, operate, and the chief point of the operation is to produce a fracture. In large bone cysts the thin bone shell can be crushed, as suggested in the older literature, which I have successfully done in a few large cysts in the upper end of the tibia.

The complete ossification of a bone cyst, especially when there has been no fracture, or but a slight one, or after an operation in which the fracture made was slight, may be slow. In one example of cyst of the shaft of the humerus, the series of x-rays demonstrated that complete ossification was not accomplished until at the end of three years.

The huge bone cyst which I reported in the *Annals of Surgery*⁽²⁾ and a few more in the *Journal of Radiology*⁽¹¹⁾ are evidence that in some instances ossification does not take place and expansion of the bone shell may go on, with so much destruction that only an amputation will relieve the condition. As pointed out in the *Annals of Surgery*⁽²⁾ attempts at resection in these huge bone cysts are associated with so much oozing of blood during or after operation, that death from hemorrhage has occurred.

Therefore, if the x-rays show an increasing expansion of the bone shell, or increasing involvement of the shaft, operation should not be delayed.

Recurrences After Operation for Bone Cysts: Now and then, after conservative operation, curetting or letting out the fluid, second operations have been performed because of refracture or slow ossification. As I restudy these cases, I am inclined to the view that the second operations were unnecessary, and were due to an incorrect interpretation of the x-ray picture and lack of knowledge of the slow ossification of the bone cyst.

POLYCYSTIC OTITIS FIBROSA

Case 1—(Pathol. No. 11466)—Figs. 1 to 8: Lesion in the lower end of the tibia involving the epiphysis. Male, aged 23. Operation, December 10, 1910, by Dr. Hotchkiss, Bellevue Hospital, New York. Ultimate result not ascertained.

In Figure 1 the anteroposterior view, we observe that the lower third of the shaft of the tibia, extending through to the epiphysis of the internal malleolus, is involved. The bone shell is intact; there is no new periosteal bone formation. The shadow suggests a polycystic condition. The tibia, towards the fibula has a thicker bone shell.

Figure 2: Lateral view. We now see that the light shadow extends to

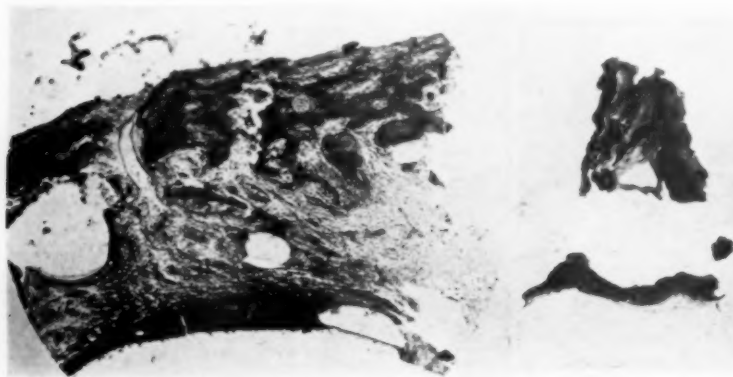


Fig. 10—Case 2—Pathol. No. 12838—Polycystic ostitis fibrosa. Microscopic picture (low power). For gross appearance see Fig. 9. Note the minute cavity, the islands of bone and the cellular and fibrous ostitis-fibrosa tissue.

Fig. 11—Case 3—Pathol. No. 12378—Photograph of



gross tissue removed from a bone shell in the ilium. Note the leathery connective tissue filled with minute cavities. Some of these contained blood. Compare with Fig. 4, polycystic ostitis fibrosa.
Fig. 12—Case 3—Pathol. No. 12378—Microscopic picture (high power). Note the islands of bone and the cellular and fibrous ostitis-fibrosa tissue.

the cartilage of the ankle-joint, and the whole lower end of the tibia is expanded and involved, with a thin bone shell. There is no evidence of perforation, or of new periosteal bone formation. The polycystic appearance seen in Figure 1 is less distinct. The shadow of the central area below is not sharply outlined from the marrow shadow above. As I have only a print and not the original x-ray, this lack of differentiation may be due to the print. We have here a distinct x-ray picture of a central bone lesion with intact bone shell, and when I compare it with others in this area and in other bones I can record that this x-ray is not pathognomonic of a benign bone cyst, and I have the x-ray of a central sarcoma of the upper end of the humerus with intact bone shell which resembles it. The involvement of the epiphysis is against a bone cyst.

Dr. Hotchkiss sent the following clinical note: "The patient is a white male, aged 23. He has observed a swelling of the internal malleolus for four years; this has gradually increased in size; there has been some pain on walking. On inspection one can see an oval tumor involving the malleolus and five centimeters of the shaft. On palpation the tumor feels like bone, smooth, hard; there is no fluctuation, crackling, or pulsation; there is no infiltration of the soft parts. The foot is held in slight inversion, abduction and adduction of the foot are limited. Passive motion elicits pain. The greatest circumference of the swelling of the lower end of the tibia measures three centimeters more than a corresponding area of the opposite leg. The patient was therefore aged 19 at the onset. This would favor a giant-cell tumor or a sarcoma rather than a bone cyst. But the duration of the swelling for four years would almost rule out sarcoma. The diagnosis rests between a bone cyst, a giant-cell tumor, a myxoma or a chondroma. The

long duration would exclude multiple myeloma or metastatic carcinoma."

Operative Pathology: Dr. Hotchkiss writes that on opening the thin bone shell he enucleated a growth filling the bone cavity. His diagnosis was sarcoma. After this enucleation or curetting, he swabbed with pure carbolic acid.

Healing of the Wound: The wound healed, from my experience, more rapidly than if the lesion had been a giant-cell tumor.

Gross Pathology: Figure 3 is a painting, Figure 4 a photograph of the tissue sent me by Dr. Hotchkiss. The tissue is of the consistency of leather; it is filled with cysts varying from one to eight millimeters in diameter; some of these cavities contain dark clotted blood. The tissue beneath the cavity is firm and leathery and not friable. Only a fibrosarcoma, or fibroma would feel or look like this tissue, but I have never observed multiple cysts of this kind in either the sarcoma or fibrosarcoma. The benign giant-cell tumor is friable, of the consistency of cheese and contains practically no connective tissue. The gross appearance in this case is that of polycystic ostitis fibrosa.

Microscopic Pathology: Figure 5 (low power): Here we see the cavities, some filled with blood, some empty; between the cavities a cellular tissue with much intercellular eosin-staining fibrous tissue, of the type seen in ostitis fibrosa.

Figure 6 (high power of Fig. 5): The larger cells lining the cavity are chiefly osteoblasts; there are no giant cells of the epulis type. These cells do not suggest the endothelium of blood vessels. The debris in the cavity is old blood and degenerated cells; no calcium.

Figure 7 (high power): There are numerous cavities with and without hemorrhagic debris; the larger cells resemble osteoblasts; the dense cellular

tissue about the cavity resembles ostitis fibrosa. There are very few giant cells of the epulis type.

Figure 8 (high power): This area contains numerous giant cells of the epulis type and many osteoblasts; the larger cells are imbedded in very cellular tissue. This area resembles the giant-cell tumor. Such areas are not infrequent in the connective tissue lining of a bone cyst. They can be picked out in the gross as red, friable areas.

We have studied these sections again and again for foam cells and have failed to find them. Figure 8 is not unlike xanthoma, except there are no foam cells and not much blood pigment.

Pathological Report by Dr. James Ewing, Professor of Pathology at Cornell University: "I think this is a true benign giant-cell sarcoma arising in the bone marrow, probably a sequel of ostitis fibrosa cystica. The dilated sinuses represent the early stages of the cystic transformation. They are lined by characteristic epulis giant-cells. Similar cells appear in foci of dissolving calcium fragments. The stroma is a very cellular and almost myxosarcomatous. At certain points the stroma is extremely cellular suggesting a true aggressive tumor."

This was written September 5, 1920. In Dr. Codman's new classification he would place this tumor in the border-line group.

Ultimate Result: About nine months later the patient again came under Dr. Hotchkiss' observation. The wound was healed. An x-ray was interpreted as a recurrence. The patient refused operation, and all attempts to follow him have failed.

From my experience, an x-ray nine months after such an operation would not show complete ossification, whether the tumor was a bone cyst or a giant-cell tumor. Therefore, we have no definite evidence that there was a recurrence.



Fig. 13—Case 3—Pathol. No. 12378—X-ray of the result eleven years after operation, showing the ossification of the cavity in the ilium, the numerous exostoses and evidence of bone in the soft parts.



Fig. 14—Case 4—Pathol. No. 25892. X-ray before operation.

Fig. 15—Case 4—Pathol. No. 25892—X-ray of result four years after operation. Original x-ray shown in Fig. 14.

Case 2—(Pathol. No. 12838)—Figures 9 and 10: The tumor involves the spine of the dorsal vertebrae in a white male, aged 17. There had been pain for seven months. At the operation by Dr. Baer in 1912 the tumor could be but partially removed. The patient is (1922) apparently well, ten years later.

Clinical Note: The record in the laboratory is incomplete. It reads: "White male, aged 17; pain in the shoulder blade seven months; worse on stooping; night sweats; shortness of breath; blood-tinged sputum."

Gross Pathology: Figure 9 is a photograph of two of the larger seven pieces received in the laboratory. It shows the distinct very thin bone capsule; the tissue is red and spongy, leathery, filled with minute cavities. The coloring is white, brown and red.

Microscopic Pathology: The old pathological diagnosis was myxoma, but on restudy of new sections (Fig. 10) there is no myxomatous tissue. There is a thin bone shell with areas of bone throughout the tumor tissue; there are numerous cysts; the connective tissue resembles ostitis fibrosa; there are numerous osteoblasts, no giant cells; the tissue is very vascular.

Ultimate Result: In 1913, one year later, the patient writes: "Feeling well; no pain in the back; some palpitation of the heart." In 1919 the patient writes a long letter which is very difficult to interpret. Apparently there is no recurrence of the tumor, but he is suffering from symptoms due to pressure on the cord.

In 1922 the patient is still living. This long period must exclude a malignant disease.

Case 3—(Pathol. No. 12378)—The lesion involved the crest of the

ilium. The operation was performed by Dr. Mixer of Boston, in April, 1910. In 1922, twelve years later, there has been no recurrence, but an x-ray showed exostoses from the pelvis in the region of the old scar. (Figs. 11, 12 and 13).

Clinical Note: (Sent by Dr. Mixer in April, 1910). The patient is a white female, aged 19. For six months there has been pain in the region of the right hip. For two months Dr. Osgood of Boston could palpate a mass below the right anterior spine of the pelvis. This palpable area was tender and the seat of pain. At this time an x-ray was reported negative.

Examination: (before operation). A palpable mass below the anterior superior spine of the ilium three centimeters in diameter, above the trochanter. No limitation of motion at the hip joint, but some pain on active and passive motion. An x-ray now shows a shadow outside of the ilium with some roughening of bone.

Operative Findings: A tumor was present in the ilium within a thin bone shell; the soft-part tumor in the bone shell was sponge-like and could be easily removed from the bone shell. Some of the shell was removed and the wound closed.

Gross Pathology: This is very similar to that in Case 1, Figure 4. The cysts are more irregular and less round; the tissue is leathery, like ostitis fibrosa (Fig. 11).

Microscopic Pathology: (Fig. 12). We have the picture of ostitis fibrosa with areas of ossification. Other sections show the polycystic type similar to Figures 5 and 10. Some of the cavities contain blood clot undergoing organization. There are many osteoblasts and a few giant cells. It is difficult to tell

whether the bone islands are old bone or new bone.

Ultimate Result: In August, 1921, eleven years later, the patient came under the observation of Dr. Mixer again, and an x-ray (Fig. 13) was taken. It showed the defect in the ilium filled with new bone and from this area two exostoses, some smaller exostoses from the top of the acetabulum, and a few dark shadows in the soft parts, suggesting bone. The new bone in the soft tissues could be easily explained by the transplantation of periosteum or bone during the operation. The larger exostoses were probably due to direct trauma to bone during operation.

The patient is well and free from pain, and there is no limitation of hip-joint motion.

The x-ray taken in August, 1921, is identical with the one taken the year before. She consulted Dr. Mixer because some months before, after mountain climbing, she began to have pain and a limp.

Case 4—(Pathol. No. 25892)—This case was reported in detail by Dr. Hitzrot in the *Annals of Surgery* for April, 1917, with reproduction of the x-ray and four photomicrographs. The lesion involved the upper end of the humerus and was within a bone shell. I reproduce here a copy of the x-ray (Fig. 14) and it should be compared with Figures 1 and 2 of Case 1.

Clinical Notes The patient is a white male, aged 25. He was examined by Dr. Hitzrot in January, 1916, because of pain in the region of the shoulder. The trouble dated back six years to an injury. During this interval there had been intermittent attacks of pain after excessive exercise, and an x-ray taken four years after the injury was reported as negative. The attack of pain here



Fig. 16—Case 5—Pathol. No. 29834—Polycystic ostitis fibrosa of lower end of tibia and fibula and metatarsal bone of great toe. Suspicious smaller areas in other metatarsal bones and in the tarsals.

Fig. 17—Case 5—Pathol. No. 29834—Antero-posterior view showing the polycystic ostitis fibrosa in the



lower portion of the shaft of the tibia without involvement of the epiphysis, and lower end of the fibula with involvement of the epiphysis.

Fig. 18—Pathol. No. 25646½—Multiple chondroma of metacarpal and phalanges of index finger and thumb and of lower end of the radius. Compare with Figs. 16 and 17.

recorded had been observed four weeks.

Examination: The deltoid area bulges. It is tender. The upper end of the humerus feels larger, and the palpable bony mass is irregular. On joint motion there is crepitation and pain. The x-ray was interpreted as showing a shell of bone divided by bone trabeculae. The majority of the visible tumor in the x-ray rests upon the old cortical bone of the shaft, but the light areas in the region of the trochanter and head suggest also a central involvement.

The preoperative diagnosis was *myxochondrosarcoma*, or some form of a bone cyst.

Operative Findings: January 11, 1916. The soft parts were uninvolved. There was exposed a thin shell of bone. On opening it there was removed some straw-colored mucoid fluid. The bone shell was lined by a mass of coagulated, slightly altered blood. The marrow cavity of the head and some of the shaft was involved. A small piece of bone was found in the altered blood clot. The inner lining of the bone shell was irregular. The wound was closed with a muscle flap.

Gross Pathology: (Dr. Elser). There is a shell of bone eight by four centimeters; outer surface smooth, inner surface low trabeculae; filling the bone cavity is bloody and necrotic material.

Microscopic Pathology: Organized blood clot. Areas of cells suspicious of sarcoma. Other sections show cavernoma.

Final Diagnosis: Cavernous hemangioma of bone.

Second Operation: In April, 1916, three months later, because of pain and restricted motion after a strenuous game of tennis, an x-ray was taken, and an exostosis was found. At the operation the joint was reopened and a small exostosis near the bicipital groove removed. There was no evidence of the recurrence of the tumor. Other pieces of bone and soft parts were removed for microscopic examination.

Microscopic Pathology: (Dr. Elser). No evidence of recurrence of the tumor. The exostosis is normal bone, the soft parts show foreign body giant cells, and blood pigment.

Ultimate Result: This patient came under my observation in December, 1920, four years after Dr. Hitzrot's operation because of pain and limitation of motion in the shoulder-joint. He had served in the army at the front and his recurrent symptoms again were due to strenuous exercise. An x-ray had been taken at Coblenz, and a German surgeon had diagnosed sarcoma and advised amputation.

The x-ray taken later at the Walter Reed General Hospital (Fig. 15) shows beautifully when compared with the result (Fig. 14) of Dr. Hitzrot's operation. Although there is considerable pain and limitation of motion the x-ray shows no areas of bone destruction and only small exostoses. The present symptoms could be easily explained by the trauma. At first we considered an operation either to remove the head of the bone and transplant, or simply to remove the roughened areas of bone. But as he improved under observation, nothing was done, and the patient is well today (September, 1922) more than two years later.

Microscopic Pathology: Through the courtesy of Dr. Hitzrot I was able to examine the original sections, and I was rather inclined to the view that it was polycystic otitis fibrosa, as the sections resemble those in Case 1 (Figs. 5 and 6). Dr. James Ewing, however, to whom I again referred these sections and those in Case 1, is of the opinion that this case operated on by Dr. Hitzrot is a definite hemangioma, and the tumor is cortical rather than central. The important point, however, is that the lesion is benign, and, although the operator, because of the x-ray picture, properly considered the possibility of malignancy, he was of the opinion later, when the gross pathology was exposed, that it was benign and treated it conservatively.

Subperiosteal Hematoma: This lesion has been described in the literature, but I have never had the opportunity to explore or study its gross and microscopic pathology. One could imagine after a trauma a hemorrhage beneath the periosteum, or a partial fracture with hemorrhage, and this hemorrhage might continue producing bone expansion, with the development of a true cyst filled with organized blood clot. This might give a picture similar to Figure 14 in the x-ray.

Case 5—(Pathol. No. 29834)—Figs. 16 and 17: This observation differs from the other four cases in that three bones are involved—the lower end of the tibia and fibula and the metatarsal bone of the great toe. The x-rays (Figs. 16 and 17) show expansion of the metatarsal and a very mottled area in the region of bone involvement.

Clinical Note: The patient was admitted to Dr. Baer's orthopedic service at Johns Hopkins Hospital, and the first metatarsal bone curetted by Dr. Ghormley, the orthopedic resident. Patient was a colored boy, aged 12. There was a history of trauma six months before, following which there was swelling, pain and limp. On pal-

pation there was found an expansion of the metatarsal bone of the great toe which felt like a bone shell. There was nothing to be made out on palpation of the lower end of the tibia and fibula. The Wassermann was positive, but the bone lesion did not improve under salvarsan. The x-ray (Figs. 16 and 17) was diagnosed multiple chondroma or myxoma. I compared the x-ray with one of my own. (Pathol. No. 24646½), Dr. Baldwin's case; the involved bones were the lower end of the radius, the metacarpal and phalanges of the thumb and index finger in a boy of 12 who dated his trouble back to an injury six years before (Fig. 18).

I was inclined to believe that both were otitis fibrosa. When Dr. Ghormley operated on the colored boy the tissue received in the laboratory was identical with Cases 1, 2 and 3, otitis fibrosa; while when Dr. Baldwin subjected his case to operation in Salt Lake City and sent me the tissue, it proved to be a chondroma. It is true, in Dr. Baldwin's case (Fig. 18) there is some destruction of the bone shell over the lesion in the phalanx, but this has also been observed in otitis fibrosa. **METHOD OF ATTACK IN CENTRAL BONE LESIONS, WITH NO EVIDENCE OF PERIOSTEAL TUMOR FORMATION.**

These cases will come under observation because of recent fracture, or contusion, or because of pain or swelling, and the x-ray will reveal a light area with more or less expansion of the bone shell. If there has been a fracture it may be incomplete or complete. There may be evidence in the x-ray of perforation or partial destruction of the bone shell. On palpation, there will be no soft-part infiltration, except in the region of the recent fracture. The bone shell is usually palpated. As a rule it is smooth. There may or may not be crepitation. I have never observed pulsation. The expansion of bone from the normal shaft from above and below may be abrupt or gradual. The markings of the light area show great differences in the same pathological types. I know of no way of making a positive diagnosis from the x-ray. I have shown here five cases in which the lesion was benign and of the type of polycystic otitis fibrosa, and one (Fig. 18) which proved to be a multiple chondroma. In the *Journal of Radiology* for March, 1920, I have reproduced a number of examples of central bone lesions: myxosarcoma (Fig. 1); bone cysts (Figs. 2 and 5); giant-cell tumors (Figs. 4 and 6); central chondroma (Fig. 15); central sarcoma (Fig. 29); central fibrosarcoma (Fig. 18); a case then diagnosed central sarcoma, now central unhealed bone cyst (Fig. 23); central

bone cyst without connective tissue lining (Fig. 27); central solid ositis fibrosa (Figs. 32 and 39); central myxoma (Fig. 28); tuberculosis (Fig. 37).

In the *Journal of Orthopedic Surgery* ⁽¹²⁾ I have reproduced the x-rays of central chondroma and giant-cell tumors of the phalanges.

In the *Annals of Surgery* for April, 1919, ⁽¹³⁾ I published the evidence that perforation or destruction of the bone shell was not a sign of malignancy.

Since the publication in the *Journal of Radiology* for 1920 I have collected x-rays of numerous central bone lesions with pathology proved by operation. The bone cysts and giant-cell tumors predominate; chondromas, especially of the phalanges and metacarpals are quite frequent; central sarcoma is rare. The central myxomas have not been observed since my report in the *Annals of Surgery* for December, 1920, ⁽³⁴⁾ and the case reported as No. 2, Pathol. No. 22929, in which the myxoma was in the center of the astragalus, has just returned under observation with metastasis to the lung.

From this accumulated experience, verified by pathological examination by a number of pathologists, I am impelled to the conclusion that the x-ray of a central bone lesion cannot be diagnosed with any degree of certainty, and that as sarcoma is possible after the age of 15, I feel it is safer to explore.

METHOD OF OPERATION

If a large bone is involved, a Martin bandage should be employed; the soft parts should be carefully divided down to the bone shell; the periosteum should not be stripped back; the bone shell with its periosteal covering should be exposed at least to the size of the area pictured in the x-ray; the bone shell with its periosteum should then be divided with the electric knife and removed.

If the central tumor corresponds with that described in this paper as typical of a benign bone cyst, the fluid may be evacuated, or the connective tissue lining removed; then a fracture should be made, or the remaining bone shell crushed and the wound closed.

In all other cases it is safer to remove the tumor tissue within the bone shell with the electric cautery; then swab the wound and the exposed soft parts with pure carbolic and alcohol; then pack the wound for a few minutes with a piece of gauze wet in fifty per cent solution of chloride of zinc.

The reason for this thermal and chemical cauterization is that it is essential in the central giant-cell tumor. With simple curetting recurrences take

place. It may accomplish a cure in a central sarcoma. (Bunt's case in the upper end of the humerus is well more than two years after operation). It is safer in chondroma, and it may accomplish a cure in the myxoma.

REGISTRATION OF BONE TUMORS

BY CODMAN OF BOSTON

These registrations bring out the fact that the differential diagnosis between ostitis fibrosa and sarcoma and between the benign giant-cell tumor and sarcoma is difficult. If many of the best pathologists disagree after a long investigation, it would seem unfair to expect one pathologist to make a diagnosis from a frozen section in a few minutes.

This thermal and chemical cauterization in curetting the central lesion does not interfere with the ossification or healing of the cavity, and, as the chief cause of death in sarcoma of bone is metastasis to the lung, it seems a justifiable procedure to employ, because the malignant tumors, sarcoma and myxoma, are rare and difficult to recognize from the benign ostitis fibrosa, the giant-cell tumor and the chondroma.

There is no objection to placing radium in the bone cavity after operation, and to giving postoperative radiation or x-ray treatment, especially in proved or suspicious sarcoma. Many of my colleagues working with me on this subject have not as yet accepted my classification into central and periosteal lesions. From the standpoint of treatment this classification seems to me essential.

CLOSURE OF THE WOUND

There is no question that in the bone cyst of any type the wound should be closed. The cavity can always be partially obliterated by crushing the shell or bone transplantation. In many cases the healing has been good without either. The remarkable feature of the bone cyst is the rapid ossification after fracture or operation.

The question as to closure of the wound and bone transplantation in the benign central giant-cell tumor is yet to be settled. The ossification after curetting a giant-cell tumor is as conspicuous by its absence or latency, as it is by its presence and rapidity in the bone cyst. This is especially true in larger tumors of the long pipe bones. If the wound is left open, healing is very slow. If the wound is closed with and without bone transplantation, it usually breaks down.

The cases of central chondroma of the phalanges have all healed well after closure without bone transplantation. The central chondroma of the lower end of the femur ⁽¹⁵⁾ healed after curetting and radium.

The proper treatment of a central myxoma is not settled.

This question of the treatment of central bone lesions will be discussed in detail in a future paper.

X-RAY AND RADIUM TREATMENT

One of my colleagues interested in the radium treatment of bone lesions wrote me in November, 1920, as follows: "I hope you will soon quit operating on all these cases, now that you have them cleared up, and treat them all with x-ray or radium, which handles them satisfactorily." My personal experience does not confirm this statement.

Radiation is unnecessary in the bone cyst and ostitis fibrosa. When we can make a positive diagnosis, because the patient's age is 15 or less, operation is indicated, if there is no fracture and the x-ray shows no ossification, or the bone shell continues to expand. I have tried intensive radiation before operation in the giant-cell tumor, in the chondroma, and in the sarcoma, without apparent benefit. If one operates on a central bone lesion in a patient over 15 years of age, in the majority of cases the lesion will be either a latent bone cyst, a giant-cell tumor, or a chondroma. All of the bone cysts and chondromas have been cured. The recurrences in the giant-cell tumors are apparently due to faulty curetting. In sarcoma and myxoma I have only one positive cure more than five years after amputation. ⁽¹⁶⁾ This patient is living in 1922, nine years after operation. A second case mentioned in this paper of a central sarcoma of the upper end of the humerus, operated on by Dr. Bunts in Cleveland more than two years ago, is apparently well. In this instance the operation consisted of curetting with chemical cauterization, followed by radiation, x-ray treatment and Coley serum. There is a third case, which I saw in the Mayo Clinic, which was first curetted and then amputated one year later after recurrence. The lesion was in the lower end of the femur, and the patient is free from recurrence, more than five years after amputation. It seems, therefore, justifiable, even for sarcoma, if the bone shell is intact, to attempt this method of attack.

1. Ann. Surg., 65:476, April, 1917.
2. Ann. Surg., 52:183, August, 1910.
3. Minnesota Med., 5:604, Oct., 1922.
4. Ann. Surg., 52:183, August, 1910.
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6. Ann. Surg., 52:183, August, 1910 (Figs. 20 and 21).

7. Bloodgood: Bone Tumors, J. Radiol., 1:147-238, March, 1920* (Pathol. No. 19179, Fig. 25).

8. Southern M. J., 16:888, December, 1920 (Figs. 6 and 7).

9. J. Radiol., 1:238, March, 1920* (Fig. 89 and its discussion, page 163).

10. J. Radiol., 1:217, March, 1920* (Fig. 19, Pathol. No. 23407).

11. J. Radiol., 1:215, March, 1920* (Figs. 13 and 14).

12. J. Orthop. Surg., 2:597, November, 1920.

13. Ann. Surg., 69:345, April, 1919.

14. Ann. Surg., 72:713, December, 1920.

15. J. Radiol., 1:216, March, 1920* (Fig. 15).

16. J. Radiol., 1:217, March, 1920* (Pathol. No. 14229, Figs. 20 and 21).

17. Arch. Surg., 4:554, May, 1922.

*—Copies available while they last, and may be obtained at the business office of the Journal.

Principles of Stereovision*

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THE perception of relief, which is furnished by the fusion of different visual impressions received by both eyes from an object in the visual field, is in a large measure a purely subjective phenomenon that permits of only relatively accurate measurement. There are numerous physiologic causes that inhibit stereognostic appreciation; such as uncompensated refractive errors that make sight more pronounced in one eye as compared to the other; or strabismus, in which a fixed point in the image fails to localize in identical situations on both retinas. These inherently physiologic factors determine the subjective degree to which stereovision is sensed; and each individual presents his own stereoscopic acumen which is beyond the control of extraneous interference.

In addition to the subjectivism of stereovision, there is an objective phase which, in roentgenologic practice, must receive the most careful study if the visualization of relief is to be accomplished by physiologic imitation. The most important single item in fostering stereoscopy is the question of illumination, which involves a proper knowledge of

1. the correct intensity of illuminant;
2. the correct distribution of illuminant.

Intensity of illumination is a basic factor in stereoscopic sensing; and it must be at once realized that too great intensity, while apparently furnishing pronounced relief, in reality distorts the proper physiologic effect of stereovision. There are two main reasons for this condition, which may be experimentally elicited as follows:

First Experiment: Arrange two blackened tin boxes so as to enclose small electric bulbs such as are used on cystoscopes, and fitted with rheostat controls. Make pin hole openings in one face of each box, just opposite the bulb. Hang the two illuminators in a

completely dark room so that they are aligned equidistant from an observer.

As the observer looks at the two pin points of light, an assistant alternately increases and decreases the intensity of the illumination in one of the sources by adjusting the rheostat. The observer notices that:

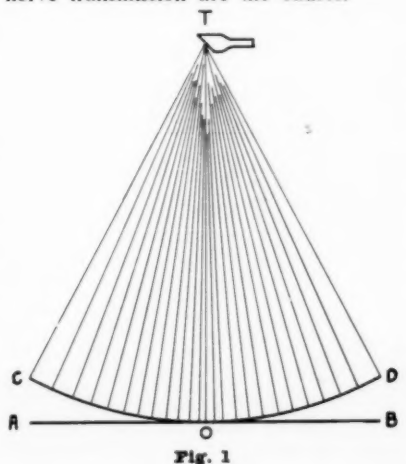
1. When the illumination is equal in each source, they both appear in the same plane.

2. As the illumination diminishes in one source, that source appears to recede into the background (actually, its position remains fixed).

3. As the illumination increases in one source, that source appears to approach the observer.

Second Experiment: Procure a hand stereoscope and some views usually provided therewith. Adjust a view so as to present maximum stereoscopic effect when observed in a moderately illuminated room. When this position on the stereoscope is reached, light a piece of magnesium metal ribbon; and after the brilliant glare has subsided, re-examine the stereoscopic view under the original conditions for which good relief was first obtained. It is found that the stereoscopic values have changed entirely and do not re-establish themselves for many hours.

Overstimulation of the retinal light receiving units and fatigue of optic nerve transmission are the causes.



From these two experiments, we find that the intensity of illumination must be correct in order to imitate physiologic stereognosis; that whereas "relief" is observed when the illumination is purposely altered, this is a spurious effect or illusion that interferes with the accurate valuation of distance perception, from which stereoscopic vision evolved. That is, it is possible to obtain illusions of relief that may be pleasing to observe (such as are purposefully sought in photoplay photography in which fictitious light values are forced in order to acquire contrast and relief); but the mere visualization of relief is not the object sought in roentgenologic practice. Here, it is desired to achieve physiologic imitation of stereovision, in order that the observed depths will represent accurately the relations of the anatomic parts under study. Beginning with the premise that roentgenologic requirements demand correct stereoscopic vision, and not simply an illusion of relief, we shall consider at this time the objective factor of illumination distribution.

An x-ray film is a flat surface upon which the x-ray radiation is projected from a point source always focused in the center of the plate. This condition is basic and follows as a prime requirement in x-ray technique; that of centralizing on the film the object to be rayed, and focusing the central ray in the middle of the object. The situation may be represented as follows: In the diagram (Fig. 1) let the line AB represent the film surface, and T the origin on the target of the radiation. The shortest distance from the point T to the line AB is, then, the central ray; and since the radiation is emitted radially in all directions, the wave front of equal radiation intensity is represented by the arc CD.

A critical study of the conditions that obtain shows that there is a single locus at the point O where the radiation is most intense; and as we recede circularly from this origin, the radiation, having travelled a longer distance and

*—Received for Publication September 18, 1922.

being influenced by the law of inverse squares, becomes proportionally less intense as the margins of the film are reached. In practice, the locus O corresponds to the center of radiographic orientation, since it is there that the most important anatomic point under examination is placed for raying.

From which we see that the distribution of x-radiation over a film surface is peculiarly arranged; and that the stereoscopic fusion of mate roentgenograms demands a distribution of illumination equivalent to the distribution of the radiation utilized in procuring the roentgenograms⁽¹⁾. Any other distribution of illuminant source will furnish an illusion of relief which is wholly different from the correct stereoscopic value of the view.

Under the means at present utilized in producing stereoroentgenograms, therefore, the formula for the physiologically correct distribution of illuminant employed for visualization is definitely fixed, as shown in Figure 2, where, in the diagram, the sketch at the left represents the x-ray intensity distribution over a film; and the sketch on the right represents the correct distribution of illuminant for proper physiologic stereovision as distinguished from spurious relief.

Around this fundamental principle a new departure in stereoscopic design has led to the creation of a novel means

for securing true physiologic stereovision as applied to x-ray endeavor. Aside from a mechanical design that lends itself to facility of use, the new instrument furnishes two unique assets.

First, a distribution of illumination mathematically coincident with the distribution of x-ray intensity on a plane surface. This is secured, in the stereoscope, by a centrally placed light source around which there are grouped reflecting walls of such design as to distribute the light on the opalite glass with accurate reproduction of the desired formula.

Then, a rheostat control that gradually increases or diminishes the intensity of the light until the "individual" or subjective physiologic requirement is obtained by the observer.

With this interestingly evolved instrument of accuracy⁽²⁾ the elements of objective stereovision in roentgenography are perfected; and there remains only to determine the individual "subjective factor," which is accomplished in this fashion:

A wax model object, or adequate substitute, is prepared so as to contain a foreign body at a given and known depth from the surface. The model is then stereoroentgenographed and the completed films fitted into their proper view boxes. The observer then visualizes the part beginning with the lowest intensity of light (rheostat all "in");

and gradually increases the light until the point is reached when the foreign body is stereovisioned at the exact depth that it is known to be. When this is realized, the observer has found his "subjective light intensity factor"; and by keeping the rheostat fixed at that position, each subsequent examination is conducted under optimum objective and subjective conditions that favor the most accurate approach to physiologic stereovision. By this means, the illusion of stereoscopy is removed; and this form of roentgen observation becomes scientifically based furnishing thereby a sound method for the correct and rapid evaluation of anatomic relations, the ideal towards which stereoscopy has, until now, futilely striven.

SUMMARY

(1) "Relief" and correct stereovision are not physiologically synonymous.

(2) Relief is a spurious effect. Stereovision is a true evaluation of depth based on subjective and objective factors.

(3) Stereovision is accurate in proportion as:

(a) the viewing light is distributed according to the producing x-ray intensity;

(b) the intensity of the viewing light is subjectively fitted for the observer.

(4) In response to these basic precepts, a newly evolved instrument for achieving maximum accuracy in stereovision, is discussed and portrayed.

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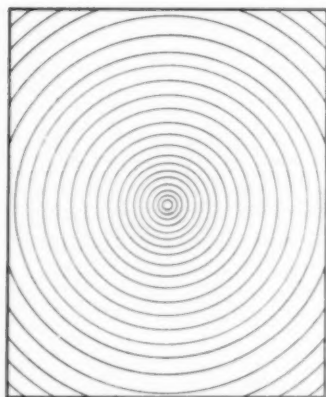
(1) *Toulouse and Pieron*: Technique de psychologie experimentale.

(2) Unpublished data from the Engineering Research Department, Victor X-Ray Corporation.

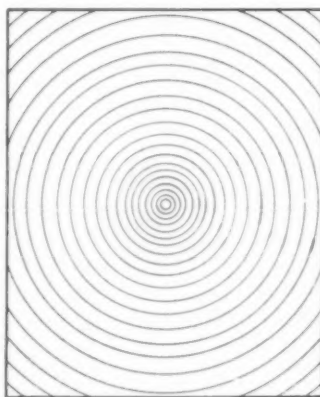
FOOTNOTES.

(1) Review first experiment.

(2) Distinguish between precision and accuracy. A thing may be precise yet wrong. For example, a length measured with a rule that is inaccurate can be measured with precision, but not with accuracy.



A



B

Fig. 2

A Summary of the Determination of X-Ray Intensities*

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AT THE annual meeting of your society in 1921 I reported the investigations I had made on the determination of x-ray intensities. These investigations were carried out for the

purpose of determining a method of treatment for deeply seated carcinomata which would assure the application of x-rays of a sufficient intensity to cause degeneration or death of the cancer growth.

The constant factors used were a maximum kilovoltage of 130, determined with a sphere gap in series with the tube terminals, a milliamper-

age of five and a broad focus Coolidge tube of a diameter of 18 cm. The variable factors were the distances from the focus or target of the tube to the surface of the skin (designated by the abbreviation F. S. D.) the ports of entry and the filter. The F. S. D. were 35, 50, 65 and 80 cm.; the fields 5, 10, 15 and 20 cm. square, and the filters 7, 11 and 16 mm. aluminum.

*—Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, May 19, 1922.

DETERMINATION OF X-RAY INTENSITIES—SCHMITZ

The transformer employed in these experiments was a Victor Snook with a cross arm type rectifier.

The summary of these results is shown in Tables 1, 2 and 3. The conclusions reached at the time were as follows:

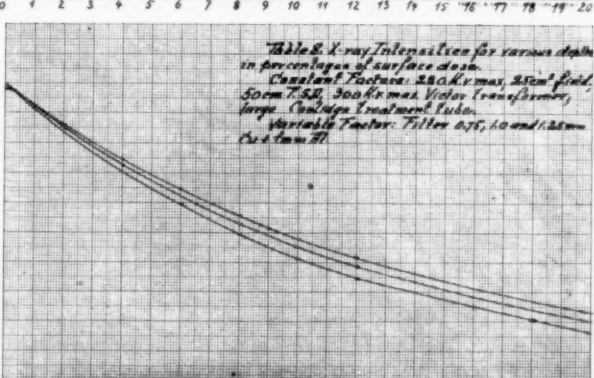
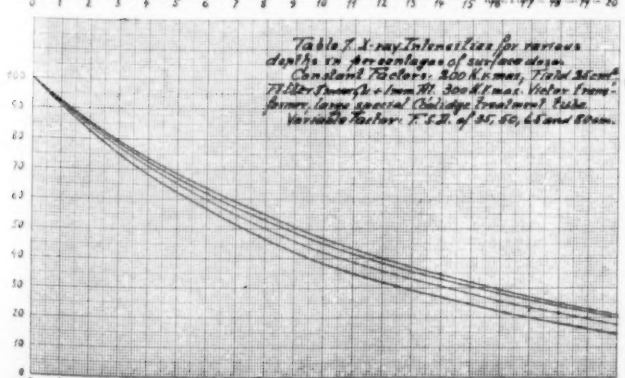
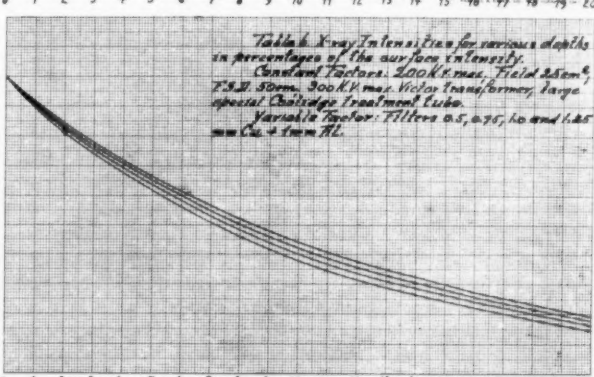
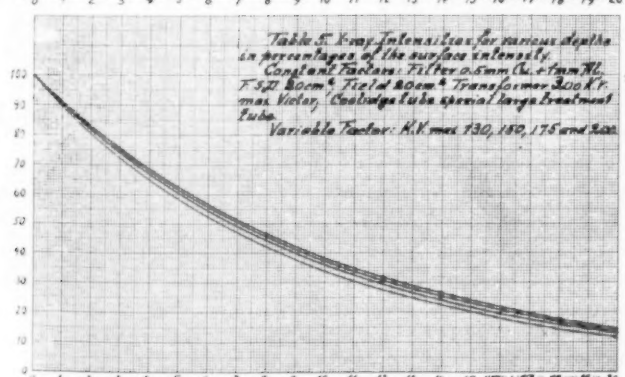
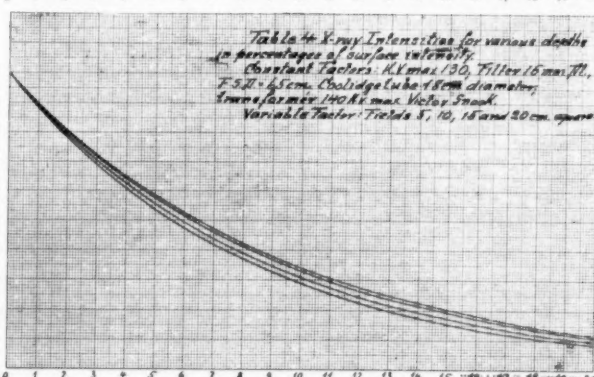
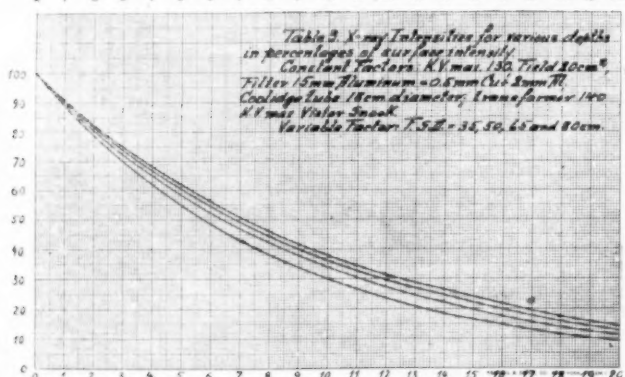
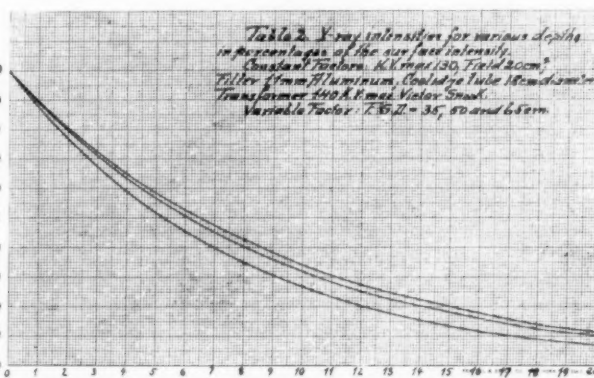
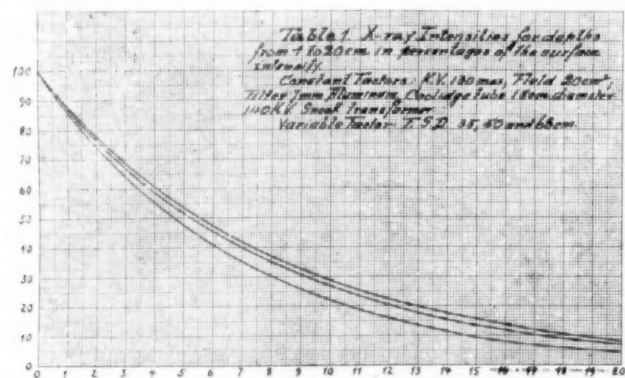
(1) Using the constant factors and a Coolidge tube of 18 cm. with a broad focus, the variable factors to obtain highest intensities are:

(a) With a filter of 6 mm. aluminum plus 6 mm. sole leather, an F.S.D. of 65 cm. and a port of entry of 15 cm. square, the milliampere minutes necessary to obtain an epilation skin dose (Ep. S.D.), are 500.

(b) With a filter of 10 mm. aluminum plus 6 mm. sole leather, an F.S.D. of 65, a field of 15 or 20 cm. square, the milliampere minutes necessary to obtain an Ep. S.D., are 750.

(c) With a filter of 0.5 mm. copper plus 1 mm. aluminum plus 6 mm. sole leather (equal to 15 mm. aluminum), an F.S.D. of 65 cm. and a field of 15 or 20 cm. square, the milliampere minutes to obtain an Ep. S. D. amount to 1,050.

(d) With a filter of 0.75 mm. copper plus 1 mm. aluminum plus 6 mm. sole leather (equal to 20 mm. aluminum), an F.S.D. of 65 cm., and a field



of 15 or 20 cm. square, the milliamperes minutes to obtain an Ep. S. D. amount to 1,500.

2. To apply x-rays to a carcinoma of the uterus we must make transverse and median sagittal sections of the pelvis of the patient just above the symphysis pubis. The sections are obtained from exact measurements of the living subject, which must include the transverse and anteroposterior and longitudinal diameters of all anatomical landmarks as well as the seat and extent of the lesion. Figure 9 represents such a measurement. It also shows that we must use four ports of entry, an anterior field of 20 cm. sq., a posterior sacral field and two lateral fields each of 15 cm. sq. We now enter the fields in this section, fix the points 1 to 11 and then enter the intensities obtained at these points through each field. If the summation of the intensities obtained through the four fields at the points selected is above 120, then the

20 cm. sq. must be employed to obtain results.

4. It may be further inferred that x-rays obtained with factors smaller than those given will not benefit the patient. An x-ray intensity of less than 60 per cent of the epilation skin dose stimulates the cancer to proliferate more rapidly, hence renders the patient rapidly worse.

5. As to the massive doses of x-rays applied, taking into account our very high skin dose, such radiations should not be repeated before the end of twelve months if at all.

6. In the treatment of uterine carcinoma x-ray radiation is invariably combined with intrauterine insertions of radium. The equal intensity curves of 50 milligrams of radium element arranged as seen in Figure 1 and filtered with 1.5 mm. brass have been determined by Schmitz and Huth.⁽¹⁾ The isodoses to obtain a cancer dose at the various percentages have been ex-

5; F.S.D., 50 cm.; field, 20 to 30 centimeters square; filter, 1 mm. copper plus 1 mm. aluminum. The number of fields is two, an anterior and a posterior one. It is only necessary to determine the anteroposterior diameter. The solution of the problem is shown in Figure 1. It does not require any further explanation.

The advantages gained by the newer method are:

1. Shortening of the time duration of the application of the x-rays. If 5 milliamperes are used the two field application consumes from three to four hours. The 130 kv. max. method consumes from twelve to fourteen hours.

2. The patients do not evince nearly as profound a radiation sickness with the 200 kv. max. method as with the 130 kv. max. method. Apparently the destruction of the blood corpuscles and normal tissues is less severe than with the old method.

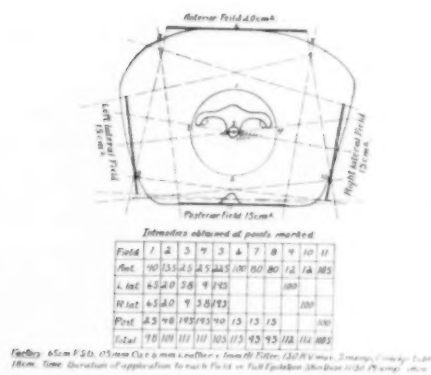


Fig. 9



Fig. 10

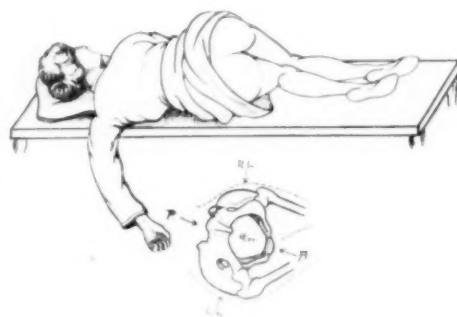


Fig. 11

time duration of application must be reduced to prevent too large an intensity at the given points, thereby preventing irreparable injuries or burns. Points 7 to 11 do really receive a small additional intensity of x-rays from the areas just external to the radiation cones. These intensities are in this instance so small that they may be neglected.

3. The results obtained from the measurements of intensities of x-rays and the studies of the topographical anatomy of the patients suffering from pelvic cancers permit the inference that with a maximum kilovoltage of 130, a Coolidge tube of 18 cm. diameter, a milliamperage of 5, a focus skin distance of 65 cm., a filter of 0.5 mm. copper, plus 1 mm. aluminum, plus 6 mm. sole leather, and a field of 15 to

pressed in terms of radium milligram element hours. Entering the equal intensity curves in longitudinal median section we may determine the time duration of the application of radium. It amounts on an average from 600 to 3,600 mg. e. hrs., depending on the size of the patient.

With the collaboration of my associate, Dr. Albert Bachem, the investigations have been extended to crest kilovoltages of 150, 175, 200 and 220. Table 5 represents the results. They were obtained with a Victor 300,000 volt transformer and the large Coolidge treatment tubes. The clinical application of these results and economic considerations, that is, saving the tubes by avoiding large loads, led us to adopt the following factors: Maximum kilovoltage, 200; milliamperage,

3. The tumor is more rapidly resorbed; evidently due to the greater biologic action of the short wave x-ray. It must be assumed, though we cannot as yet prove it, that the shorter the wave length of the radiation the more intense is the biologic action on the tumor cells. The gamma rays of radium possess the shortest wave length of any radiation known. Gamma rays of radioactive substances cause a much more rapid regression of cancer tumors than any x-ray produced so far.

4. The same intensities of radiation may be closely reproduced if the same factors, that is, kilovoltage, focus skin distance, filter, size of field and tube are employed. It is, however, advisable to determine the time duration of application carefully for each transformer and for each tube.

Weight Development in White Rats as Influenced by X-Ray Exposure*

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TO THOSE of us who are employing x-ray in treatment of the hypertrophied tonsil, certain very salient questions have arisen, which may be briefly classified under two heads:

1. Have we sufficient evidence from our pioneer investigators to feel certain that the x-ray does reduce the size of the tonsil under treatment?

2. If the tonsil is markedly influenced by the ray, have we evidence to prove that other glands, such as the thyroid, are not also affected? Or, to change the question, has enough basic biologic research work been done to finally establish what good can be done in this field, and whether or not harm attends the good?

This explains the author's point of entrance into this field of research, a partial and preliminary report of which is herewith presented.

But, first, let us review the literature:

In 1921, writing on the chemical effects of alpha particles and electrons, Lind says: "It has been found that it is the physiological effects of the gamma rays which are utilized therapeutically. But whether or not the effect is produced through the intermediation of chemical action remains as yet wholly unknown."⁽¹⁾

Dorsey, speaking of radium, says: "In their passage through matter, both gamma and x-rays cause high speed electrons to be ejected from a small proportion of the atoms over which they pass. These electrons are similar to beta rays; the velocity with which they are ejected depends upon the wave length of the wave causing their ejection—the shorter the wave, the higher the velocity. Those ejected by the short gamma ray waves have a very much higher velocity than those ejected by the much longer x-ray wave. One effect of both gamma and x-rays is to cause the entire mass through which they pass to be subjected to this beta ray bombardment. It is to this beta ray bombardment that the biological effect of these rays is generally attributed."⁽²⁾

Regaud, 1920, says: "Some little penetrating and therefore easily absorbed rays have a general caustic action, but the more penetrating rays have an 'elective cystcaustic action.' * * *

There is a long scale of radiosensitivity for animal cells, ranging between the most radiosensitive (such as certain sexual and leukocytic cells) and the least radiosensitive (such as muscular fibres and nerve cells). The radiosensitivity, too, is a property of the nucleus and is inherent in certain states or temporary physiological periods of cell life, the most important and best known of which is the state of reproduction. Another period of heightened sensibility corresponds to the maximum metabolic activity of the nucleus in cells which have a secretory function. And since such cell division and nuclear metabolism are neither continuous nor prolonged states, it follows that the same cell or generation of cells manifests alternating radiosensitivity and radioresistance. The effect on the cell is shown by every grade from early death to slight reparable injury. The dead cells are removed by autolysis or phagocytosis, but the intercellular substances are resistant and absorbed slowly."

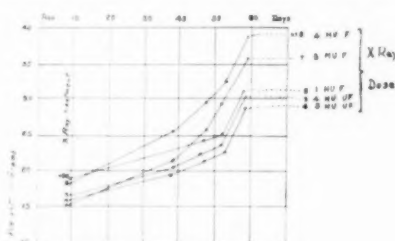
Arguing from these premises, Regaud asserts that: "X-ray and gamma-radiations of very short wave length are elective poisons for nuclear chromatin, upon which, as is known, heredity depends. Hence, the rays suppress or suspend cellular reproduction in a tissue. The radiosensitivity of connective tissue and lymphoid malignant new growths is as follows, the varieties of tumor being given in descending order

of radiosensitivity: lymphosarcoma, large and small round cell sarcomata, mixed-cell sarcoma, fibrosarcoma, chondrosarcoma, osteosarcoma."

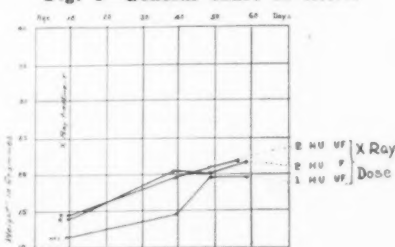
Dr. Lazarus-Barlow, in commenting, says: "It is possible to doubt some of the premises and hence the conclusions, obvious or concealed, to which Dr. Regaud is conducted. Thus he repeats on at least three occasions that the action of the rays is local. No doubt in a sense this is true, but the mere facts that the intensity falls off according to the law of inverse squares, and that a circulation passes through the irradiated part, indicate that a general effect of irradiation has to be reckoned with. These distal effects of the rays may well be of great importance. Quite apart from the fact that at some distance an 'elective cystcaustic action' must become converted into an 'elective cystostimulative action,' just as at some distance an irritant induces repair, it is possible that the lymphocytic changes following on irradiation may indicate a fundamental process which is general and not local. Without wishing to be dogmatic, there is some reason for believing that patients showing little lymphocytic fall in the circulating blood upon irradiation react better to the treatment than those in whom marked fall occurs. And just as Dr. Regaud advises combined x-ray and radium treatment, so it may be combined beta and gamma x-ray treatment would give better results than either of these alone. The premise that the action of the rays is purely local has a cramping effect. Probably, too, in considering the action of rays upon cells, attention has been riveted too much upon the nucleus."⁽³⁾

Russ, 1921, speaking of local and general action of radium and x-rays on tumor growth, says: "Prolonged exposure of the animal to the rays results in wasting and death. As the dose of radiation becomes less a stage is reached where the rate of increase of body weight exceeds that of the normal (15 per cent in 60 days)."⁽⁴⁾

From the Rockefeller Institute come some very valuable reports, showing that "mild doses of x-ray stimulate lymphocyte formation, and heavier doses of longer exposure, almost completely destroy both lymphoid tissue and circulating lymphocytes, without apparent damage to other tissues."⁽⁵⁻¹¹⁾



Weight Line of 10, 9, 8, 7 & 6 Litter J
showing weight increase throughout life.
1924 Dr. S. E. Sanderson, Detroit, Mich.



Weight Line of 3, 4, 5, 7 & 8 Litter J
showing same as selected rats.
1924 Dr. S. E. Sanderson, Detroit, Mich.

*—Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, May 20, 1922.

Dr. A. S. Warthin, Jan. 16, 1922, writes in a private communication: "Specific changes in tissues: (1) The action upon the nucleus of the lymphoid cells. (2) Skin and thyroid in the production of atypical regenerative forms of epithelium showing themselves frequently as syncytial giant cells. This action upon the regenerative ability of the tissue is, outside of the action upon the lymphoid tissues, the most striking result of irradiation in my experience." (12)

Davey, 1919, writes that "an evident prolongation of life of the *Tribolium confusum* is apparently due to small doses of x-rays." (13)

Mavor, working at Union College, indicates that "the most marked effects of radiation lie in the chromosomes of the cells, and possibly are most marked at the stages of cell division." (14)

In our work, the prime search was for biologic change. Reports on these changes are not yet completed, and will be presented at a later date. Starting with the very young baby rat, even exposing the embryo rat in utero to x-ray and waiting for histologic changes to occur, many marked macroscopic changes were observed: One phase of these forms the subject of this report, viz., weight development. We have had deformed rats—born without eyes, born without tails—but at this time, we will limit ourselves to one litter of eight (Fig. 1). All conditions surrounding these rats were alike for all individuals, except x-ray treatment. The rats were about ten days old at the time of exposure, hairless and still blind. One general dose was given, this being changed only in two particulars, namely, time and filter. The unit was about the Holzknacht unit and was changed by changing the time only, 3 in. spark, 3 ma., 8 inch distance, time, four minutes. Half the litter received the exposure without filter and the other half with a filter of two millimeters of aluminum, and one thickness of sole leather. The lantern slides will graphically set forth the variation in weight development of the individuals. Having weighed many untreated rats we observe that Nos. 1, 2 and 6 (Fig. 3) average about as controls. The two animals, Nos. 7 and 8, (Fig. 2) at

the end of sixty days, reached the highest weight and had had the largest dose of the litter. Numbers 3, 4 and 5 (Fig. 2), arrived at a medium weight and had had a medium dose, whereas Nos. 1 and 2 (Fig. 3) showed least weight, having had the smallest dose. Number 6, grouped with 1 and 2, can only be explained by speaking of it as the omnipresent exception to the rule. In as extensive a review of literature as we have had before us, we find but one author speaking of the effect of radiation on the weight of white rats. Russ writes: "The prolonged exposure of the animal to the rays results in wasting and death. As the dose of radiation becomes less, a stage is reached where the rate of increase of body weight exceeds that of the normal (15 per cent in 60 days)." In this series it would not appear that we had given a harmful or withering dose to any individual, though from other series we do know that such an effect can be produced.

Litter J			
X-Ray Dose	Holzknacht Unit	Filter	Remarks
1	2 MU	0	UP
2	4 MU	0	UP
3	6 MU	0	UP
4	8 MU	0	UP
5	10 MU	2 mm Al	UP
6	12 MU	2 mm Al	UP
7	14 MU	2 mm Al	UP
8	16 MU	2 mm Al	UP

Holzknacht Unit: 3 mm spark, 3 ma., 8 in. dist., 4 min. exposure time.
Filter: 2 mm Al, 1 Sole Leather.
One litter only.
One exposure only, at age of 10 days.
All other conditions alike.
1922 Dr. S. E. Sanderson, Detroit, Mich.

Fig. 3—Weight chart of Nos. 1, 2 and 6 of the same litter.

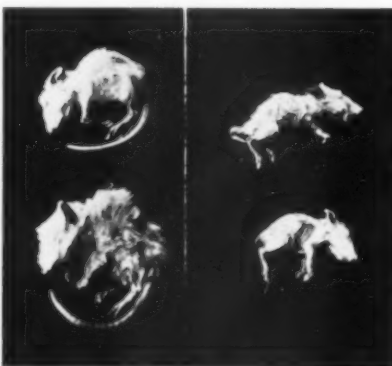


Fig. 4—Photograph of some animals which received treatment.

It does, therefore, seem feasible to assume that a gradation of dose exists which, in respect to body development, varies in results, from ineffective, through stimulating, up to destructive results. How this is accomplished, what part the endocrine glands play, how we can use alpha and beta rays, how we can use gamma rays, whether x-ray and gamma rays are ineffectual in themselves and whether they become effectual only when transmuted into beta-ray bombardment are all problems forming a fascinating subject, upon which much thought and study can be expended and ultimate findings are still for future research.

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The Problem of High Potential Measurement as Associated with Deep Therapy at High Voltages*

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THERE are two obvious means of standardizing x-ray measurements, to enable accurate repetition of dosage with the same apparatus, or to permit the results of one investigation to be applied by another with a different apparatus.

The first of these means is to measure the x-rays emitted from the tube, and to use this measure as a basis of comparison. While this seems the most logical system, the apparatus for accomplishing it has not yet been developed to a point where it has wide practical utility, and we are forced to continue the use of the second type of readings.

These, in brief, constitute an attempt to predict what comes out of the tube, in the form of x-rays, from a statement of what we are putting into the tube, in the form of electrical energy. In doing this, we have customarily measured two electrical quantities—current, with the milliammeter, and voltage, with the kilovolt meter, or with a spark gap.

We have then assumed that, if we obtained a certain result when operating one machine at a given milliamperage and spark gap, we would get a sufficiently accurate duplication of this result on a different machine, if only we set for the same milliamperage at the same gap.

This is only comparatively true, however. At the lower spark gaps, such as

are used for radiography, it will serve fairly well. At the higher gaps, such as are generally used in therapy, certain discrepancies begin to appear, while at the very high voltages now being used for deep therapy, there is every reason to expect greater discrepancies. We would most certainly not rely too heavily upon a spark gap (or even sphere gap) readings as an index of the performance of all types of high voltage x-ray apparatus under all conditions, until the accuracy of the method is supported by better evidence than we have at present.

In order to illustrate this source of error most readily, let us imagine a slow moving picture showing graphically the rotation of the rectifier member in an x-ray machine, with the resultant increase and decrease of voltage and current applied to the x-ray tube during a single pulse or alteration. Further, suppose we are using high voltage and heavily filtered rays, and that our picture also shows graphically the nature of this x-ray pulse.

Beginning at the point where the voltage from the transformer is zero, we find that the rectifier is in such a position that the circuit is open and no current flows. Hence, no x-rays are produced.

Now, as the voltage rises, and the rectifier rotates, we eventually reach a point where a spark passes, a current flows and x-rays are produced. However, with the average rectifier, this current begins to pass long before the voltage has reached its maximum; and with heavy filtration, rays produced much below the maximum voltage do not pass

through the filter in any great quantity. Therefore, it is not until the voltage ever, rises to its saturation value all-useful radiation is obtained.

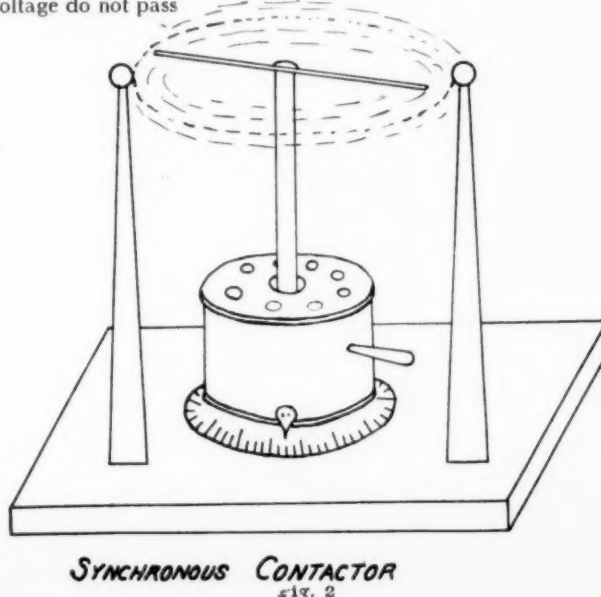
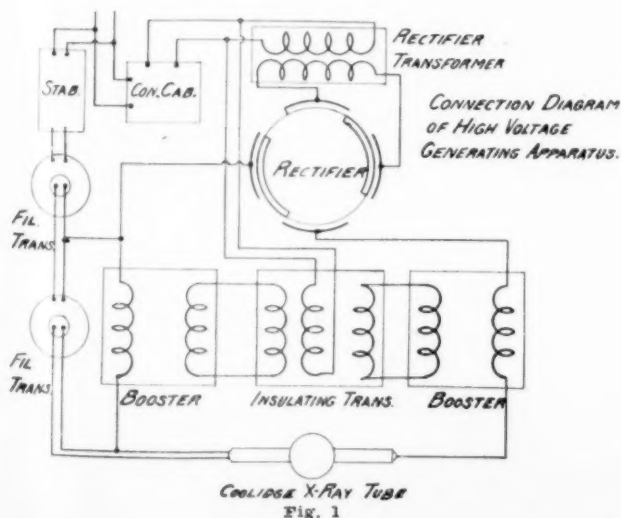
The current through the tube, however, rises to its saturation value almost as soon as the circuit is established, and remains at this value as long as the pulse continues. That is to say, there is no gradual increase and decrease of current as we pass from lower to higher voltages and back, and therefore, if we observe an increasing and decreasing pulse of filtered rays during the cycle, we should ascribe it solely to the change in voltage—since the current has remained substantially constant.

To return to the voltage—as this factor increases, the rays produced become more penetrative and hence, more and more of them pass through the filter in the form of useful radiation, until, when the voltage in the pulse has reached a maximum, a maximum of filtered rays is being delivered. Naturally, as the voltage in the pulse decreases, the radiation falls off correspondingly.

We have thus produced during a single electrical pulse, a pulse of filtered x-rays containing a certain total quantity of radiation, a fraction of a dose. The exact amount of radiant energy in this pulse depends upon the following three factors:

- (1) The transmitting characteristics of the filter.
- (2) The average current in milliamperes.
- (3) The applied voltage.

*—Read at Midyear Meeting of the Radiological Society of North America, St. Louis, May 20, 1920.



We can easily duplicate the filtration accurately by using a filter of like material and like thickness. We can likewise duplicate the current factor accurately by a return to the same average milliamperage, especially since the saturation characteristic of the Coolidge tube gives us an almost uniform current during the entire pulse. But the voltage factor is not so easily duplicated.

As we have seen, x-rays only begin to pass through the filter when the voltage gets high, they increase when it gets higher, and they persist only as long as it stays high. Thus, in estimating filtered x-rays, what we really want to know is how high the voltage gets and how long it stays high.

Now, let us consider the various means of measurement in common use and see how well they enable us to answer this question.

First in order comes the voltmeter, variously termed kilovoltmeter and spark meter, and connected either in the primary circuit of the transformer or in a special secondary circuit.

This instrument gives a reading proportionate to the average effect of the entire voltage pulse, making no allowance for the fact that only the higher portion of this voltage pulse is passed on the tube through the rectifier, and only the very highest portions produce appreciable filtered x-rays.

A slight change in wave form, resulting in a small percentage increase or decrease in the crest value, will, therefore, produce no great change in the total effective potential, although it may vary the emission of filtered x-rays by several hundred per cent.

This readily explains the known inaccuracy of the voltmeter for x-ray purposes, since the wave forms on different machines may differ widely, and the wave form on the same machine may be made to change through a considerable range by changing circuit conditions, for example, changing from rheostat to auto-transformer control. A voltmeter has, however, the advantage that it may be read continually during operation and changes in line voltage may be thus detected and compensated for. It also has the advantage that a return to the same setting and the same milliammeter and voltmeter readings on the same machine should permit a reasonably accurate duplication of results.

Now, let us consider the spark gap and more particularly the sphere gap, since this form has been widely advocated for the measurement of the very high potentials used in therapy.

The sphere gap is free from many of the vagaries of the point gap and will consistently register the maximum voltage. Only one correction need be applied for accurate work, the one for

variations of barometric pressure due to altitude. And it can be duplicated accurately in construction, one sphere gap will read exactly the same as another of the same size, which was far from true with point gaps.

But, any spark gap only tells us how high the voltage got—and that is only half of our question. The other, and equally important half, "How long does the voltage stay high?" is not indicated at all by spark gap readings.

To illustrate, let us say we are producing filtered rays, and we set a sphere gap for two hundred kilovolts and then gradually increase the output of our apparatus until the gap flashes over.

All we have found out is that at some point one of the voltage pulses applied to the tube reached a voltage of two hundred kilovolts. We have not the least idea whether it stayed at or near that value for five thousandths of a second, or one thousandth of a second, or even one ten-thousandth of a second. The sphere gap would have flashed with equal readiness.

And yet a high voltage crest lasting five thousandths of a second would cause five times the quantity of filtered x-rays to pass that would be caused by a pulse lasting one-thousandth of a second, and fifty times as many such rays as would be generated by the pulse of one ten-thousandth second.

So we come to the conclusion that we can only trust sphere gap readings as an index of filtered x-ray emission if we can be sure that all x-ray machines, under all conditions, produce voltage pulses that stay at a higher value for the same proportionate portion of a cycle.

This seems rather a fragile basis on which to rest so important matter as dosage standardization, especially in the light of the following well established characteristics of the sphere gap.

This device was originally developed for the measurement of alternating potentials, and was found to give consistent readings corresponding to the maximum or crest potentials. However, it was soon found that if sparking or even heavy brush discharge was permitted in the circuit containing the sphere gap, surges were thereby excited and the readings could no longer be depended upon to correspond to the truer crest values of the alternating potentials. As a consequence, one of the precautions widely recognized in the use of the sphere gap on alternating circuits is that no sparking or brush discharge be permitted in the gap circuit.

So much for the engineering use of this instrument. Now comes the x-ray art and appropriates the sphere gap bodily for use in circuits where there is always a large amount of sparking

and brushing. We should naturally expect errors to result. And when we consider that the higher the potential, the greater the surge tendency, we are justified in looking rather dubiously at the sphere gap as a standard for high voltage deep therapy, at least, until we have more experimental evidence.

The following brief account of work done by the writer may serve to supplement the work of others along these lines and to promote further discussion and investigation. This work includes the following points, briefly tabulated:

- (1) The development of a high voltage x-ray circuit which would minimize the surges delivered to the tube.
- (2) Tests of the sphere gap as a measuring instrument in such a circuit to determine the voltage limits for consistent readings.
- (3) Development of an apparatus for determining by absolute measurements the maximum potential and the wave form in a high voltage circuit.
- (4) Readings taken with this apparatus on the new circuit, with a chart of typical wave form.

Surges which originate in an x-ray machine and are transmitted to the tube circuit are caused by the sudden release of electrical energy from a circuit under stress, when the rectifier has rotated to a point where the current can jump from the moving to the stationary members and complete the circuit.

The sudden starting or stopping of an electric current causes temporary abrupt rises in potential, whose effect may be roughly compared to the jarring effect produced in a water pipe when a full flow of water from the tap is abruptly shut off.

These electrical surges may be prevented from reaching the tube circuit by interposing resistances or choke coils, and a tube circuit thus freed from the influences of surges should permit of much more accurate measurements of voltage.

However, stopping surges by resistance or choke coils would result in a certain drop in voltage between the transformer and the tube, which is not desirable. The circuit shown in Figure 1, however, has the advantage of preventing the surges from reaching the tube circuit, and at the same time has no voltage drop. Briefly, this arrangement consists in adding to an x-ray transformer and rectifier a pair of supplementary transformers, one of which is inserted in each of the wires leading from the x-ray machine to the tube.

These supplementary transformers are arranged so that the sum of the voltage contributed by them to the circuit is identical with the voltage furnished by the x-ray machine.

Thus, with this arrangement, an x-ray machine capable of furnishing 150,000 volts crest potential, may have added to its output an additional 150,000 volts crest potential, making a total potential applied to the tube of 300,000 volts.

Using this apparatus, tests were made to determine its adaptability to operating the large Coolidge tubes for deep therapy, and to determine, if possible, the safe voltage limits of operation for such tubes.

Starting at 200,000 volts, the voltage of the apparatus was gradually increased, and maintained for a considerable time at each new value in order to determine the performance of the tube.

The crest potential readings with a sphere gap were frequently repeated at each value of applied voltage and from the consistent repetition, or lack of it, in such readings, an attempt was made to discover whether surges were present in the circuit.

At the 200,000 volt limit, the tubes operated with almost suspicious smoothness, and the sphere gap readings could be repeated as often as desired with absolute accuracy.

As the potential was increased, a point was finally reached where two things happened. First, the sphere gap readings began to show wide irregularities for the same applied primary voltage. Although the filament current and the milliamperage were kept constant by means of a stabilizer, and no other variations were observed in the circuit, the sphere gap readings taken in succession would vary by as much as fifteen per cent.

The second phenomenon which made its appearance simultaneously with the irregular sphere gap reading, was an electric discharge from the anode terminal of the tube, extending out over the stem and the bowl. This discharge at first showed itself in the form of small snapping sparks, rapidly repeated, and as the voltage became somewhat higher, it assumed the form of an almost continuous fluttering blue brush discharge, giving a soft, tearing sound and punctuated occasionally by

bright snapping flashes to some part of the bowl.

This condition was very probably caused by an accumulation of a negative electric charge on the inside of the bowl of the tube, with a consequent darting out of a positive charge from the anode to neutralize it.

This condition of irregular discharge immediately generated surges in the circuit, the irregular effects of which were reflected in discrepancies in the sphere gap readings.

Not all tubes reached this critical condition at the same potential. A tube which has not been well evacuated, or subsequently "seasoned" by speedy operation at a lower voltage, will act in this irregular manner at a comparatively low voltage, possibly only slightly in excess of 200,000 volts.

On the other hand, a well pumped and "well seasoned" tube behaves surprisingly well on this circuit. We found it possible to operate some tubes as high as 275,000 volts and for extended periods without any irregularities.

An attempt was next made to determine the wave form or shape of the electrical pulse delivered from this apparatus to the tube. For this purpose, a rotary contact arm driven by a synchronous motor was so arranged that current from the high voltage line could be led through it to an instrument for measuring voltage.

Figure 2 shows this contact arm, illustrating also the means by which the synchronous motor may be rotated on its mounting so that contact is made at any desired portion of the wave.

Figure 3 shows this contact arm in use in conjunction with a kilovolt balance—an instrument for weighing the electrostatic attraction between two opposed plates of known area. If suitable precautions are employed it is possible to compute from the dimensions and construction of such an instrument the absolute value of the voltage charge. It was desired in these experiments to compare this absolute value with the crest value of po-

tential as shown by the sphere gap.

Figure 4 illustrates a typical potential curve taken with this apparatus on the circuit just described. The crest voltage as shown by the kilovolt balance was 240,000 volts, while the sphere gaps indicated an average of 243,000 volts. A well seasoned tube was used in this experiment, and consistent repetition of the sphere gap readings was, therefore, possible.

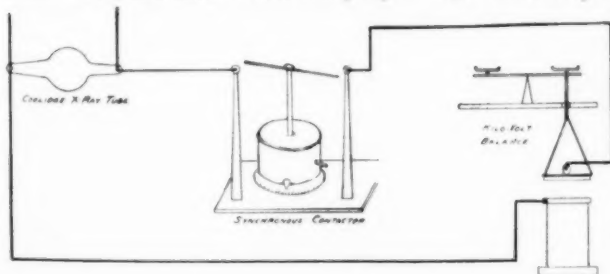
SUMMARY

(1) Standardization of x-ray work in terms of the electrical energy put into the tube is not possible unless the wave form of the exciting apparatus is known, in addition to the crest kilovolts and the milliamperes.

(2) A circuit is described which suppresses surges due to the operation of the rectifier. With this circuit and a well seasoned tube, consistent operation is possible at somewhat higher than the usual voltages. The limit to such operation is reached when surges are generated by the x-ray tube itself. It seems probable that the limit of operation of the ordinary form of apparatus employing a transformer and rectifier may be partly due to surges from the apparatus, and also partly due to the enhancing effect of the x-ray tube upon such surges.

(3) An experimental apparatus is described which makes possible the investigation of the entire range of wave form from any x-ray machine. Wider investigations with this instrument should enable us to determine accurately and easily the difference, if any, between the wave forms of commonly used x-ray machines and in the light of these differences, standardization can be more intelligently affected.

(4) It seems possible to develop from this experimental wave tracer an instrument for continuous use in x-ray plates to replace the sphere gap as a means for measuring input energy.



APPARATUS FOR TRACING VOLTAGE CURVE
Fig. 3

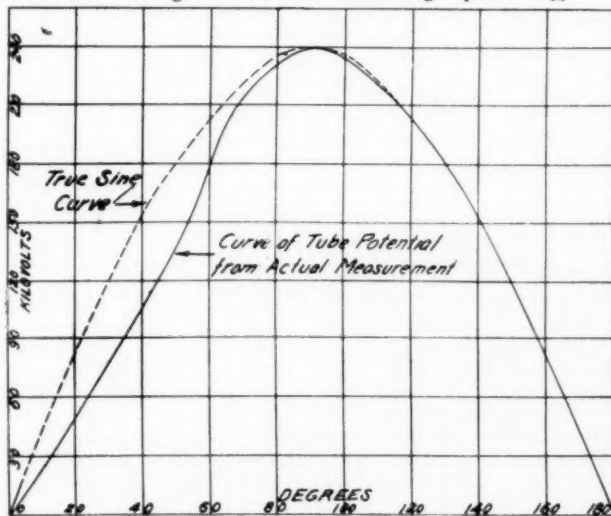


Fig. 4

EDITORIAL

The JOURNAL OF RADIOLOGY

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Annual Meeting

THE UNIVERSAL feeling of all those in attendance at the annual meeting at Detroit in December was that this was one of the most profitable meetings ever held by the Radiological Society. The attendance was large and the program was exceptional. Only one criticism could possibly have been made of the program and that was that there were too many papers. This number allowed no time for discussion in many instances.

There were two papers on the program which called forth many comments. One was by Dr. Lewis Gregory Cole on the examination of the cervical spine and the other was by Dr. Amedee Granger on examination of the sinuses. Both of these papers will appear in an early number of the Journal.

The commercial exhibit was large and was unusually well attended by those at the meeting. The commercial men expressed themselves as highly pleased with the arrangement provided for them.

The committee on local arrangements deserves great credit for providing for the scientific sessions, the social functions and for the scientific exhibit in the way in which they did. The scientific exhibit was unusually interesting and was constantly attended.

Gold Medals

FOLLOWING the usual custom of the Radiological Society gold medals were awarded to four who have rendered some conspicuous service to the science of radiology. This year gold medals were awarded to Maud Slye, Ph. D., Chicago; Dr. Percy Brown, Madison, Wisconsin; Madame Marie Curie, Ph. D., Paris, France, and Dr. Gosta Forsell, Stockholm, Sweden.

Honorary Degrees

IT IS the custom of the Radiological Society to annually confer the honorary degree upon two members of the society who have rendered outstanding service to the profession. This year the degree was conferred upon Dr. Francis H. Williams of Boston and Dr. Francis Carter Wood of New York City. Sketch of the work of these two men is found following.

FRANCIS HENRY WILLIAMS, M. D.

FRANCIS HENRY WILLIAMS, one of the distinguished sons of Massachusetts, was born in Uxbridge of that state in 1852.

At the age of twenty-one years he graduated from the Massachusetts Institute of Technology and in the following year he went to Japan as a member of the U. S. Transit of Venus Expedition. During the next year he completed the tour of the world thus begun, and, returning home entered Harvard Medical School, from which he was graduated in 1877. The next two years were spent in European study, and since 1879 he has practiced medicine in the city of Boston, where he has held various positions of merit and honor. During the great war he was a member of the Volunteer Medical Reserve Corps, and he also devoted much time to experiments connected with methods of detecting submarines.

From 1879 to 1883 he was Dispensary Physician at Harvard Medical School, where he taught materia medica and general therapeutics, and where he developed the method of giving bedside instruction in the wards to small groups of students. From 1883 to 1913 he was Physician to the Out-Patient Department, Assistant Visiting Physician, and Visiting Physician of the Boston City Hospital. In 1913 he became Senior Physician of that institution.

It was Dr. Williams who introduced into Boston in 1892 the practice of making bacteriological examinations of the throats of diphtheria patients and who in 1894 introduced the use of diphtheria antitoxin in that city.

Early in 1896 he began using x-ray examinations with a view to their employment in the diagnosis of pulmonary tuberculosis. These first examinations were made in the Rogers Laboratory of Physics of the Massachusetts Institute of Technology. In April, 1896, he published in the Boston Medical and Surgical Journal "A Note on X-rays." In May of that year the x-ray department of the Boston City Hospital was unofficially established through Dr. Williams' influence, he at this time doing all the work and providing the necessary apparatus and materials. In 1912 he instituted here the practice of precautionary x-ray examination of the chest. In 1915 he resigned as Chief of the X-ray Department, but continues to hold his position as Visiting Physician.

In 1900, at the suggestion of Dr. William Rollins of Boston, Dr. Williams first used radium, and in 1903 used pure radium bromide in the treatment of epitheliomas and some other skin diseases at the Boston City Hospital. His first article upon the treatment of tonsils with radium was published in March, 1921, and this was followed by the presentation of this subject before different medical societies in 1921 and 1922, and the publication of a further article in the Boston Medical and Surgical Journal, September 14, 1922.

Dr. Williams is a member of the Union Boat Club and of the Harvard Club of Boston, also of the Technology Club and the Century Club of New York City. He has been a member of the Corporation of Massachusetts Institute of Technology since 1882 and was a member of the executive committee of that corporation during the first twenty-five years of its existence.

He is a member of the Massachusetts Medical Society, the American Medical Association, the Society for Pharmacology and Experimental Therapeutics, and the Association of American Physicians, of which he was president in 1918. He is a Fellow of the American Academy of Arts and Sciences, a member of the American Association for the Advancement of Science, a member of the Societe de Radiologie Medicale de France, and corresponding member of the K. K. Gesellschaft der Aerzte in Wien. He is an

honorary member of the American Roentgen Ray Society and of the American Radium Society.

Dr. Williams, besides his many contributions to current medical literature, is the author of "The Roentgen Rays in Medicine and Surgery" of which three editions have been published. Following is a bibliography of his writings, published and unpublished:

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FRANCIS CARTER WOOD, B.S., M.D.

DURING the past few years Dr. Wood has devoted a large part of his attention and study to the problem of the biological action of radium and of x-rays on isolated tissues and on tumors, and in collaboration with his assistants has published several papers which report his findings.

One of the most important results of this study has been the determination of the lethal dose of radium and of x-ray for the cells of animal tumors. (Wood, F. C., and Prime, F. The action of radium on transplanted tumors of animals. *Annals of Surgery*, 62:751, 1915. Lethal dose of roentgen rays for cancer cells. *Journal of the American Medical Association*, 74:308, 1920.) In this work a mouse tumor has been used (Crocker Fund No. 180), and it has been suggested by Dr. Wood that this tumor, because of its constant and tested biological qualities, be used as a standard for the calibration of x-ray machines and ionization apparatus, so that each operator may control the workings of his machine exactly. The use of this tumor as a standard will also make possible a biological comparison between the action of x-ray and that of radium and permit the estimation of equivalent dosage. Crocker Fund tumor No. 180 has already been distributed from the Crocker Laboratory to a number of institutions throughout the United States and Europe and is available to any workers who desire it.

Under Dr. Wood's direction there was installed this year at St. Luke's Hospital, New York, a high power x-ray plant for the treatment of patients, and there is now at the Crocker laboratory, also under his direction, an x-ray machine designed to deliver 200,000 volts direct current.

There have been carried out in the laboratory by members of the staff, all under Dr. Wood's direction, important series of studies on immunity in its relation to cancer, and by one of these it has been definitely shown that the theory that immunity might be induced by the stimulation of lymphocytes by the x-ray was not well founded.

By another long series of experiments carried out in the laboratory it was proved that the incision of a tumor and the removal of a small fragment for microscopical study does not result in the distribution of the tumor cells, as has been asserted, and is an entirely justifiable procedure when diagnosis can not be made by other means. (Wood, F. C., Diagnostic incision of tumors. *Journal of the American Medical Association*, 73:764, 1919).

On the other hand, other experiments have proved that gentle massage of transplanted tumors results in a great increase in the number of metastases, which indicates the danger of palpating or handling a human tumor before its removal.

Extremely interesting and suggestive experiments have been continued on the artificial production of cancer in rats. It has been observed that the offspring of rats which have developed cancer under irritation show a much greater susceptibility to such irritation than their parents, as far as one strain is concerned. In another strain of animals which are

outwardly exactly similar to the susceptible ones, few tumors ever appear, though the irritation applied is quantitatively exactly the same, and what is more strange, if no irritation is applied these animals never develop cancer. Hence, Dr. Wood questions whether cancer is hereditary, as has often been assumed, but believes rather that there may be transmitted under suitable conditions a sensibility of the tissues to irritation. If sufficient irritation is then given cancer will be produced, if the tissues are not irritated the animal remains in health. These experiments, however, should not be considered as suggesting the probability that such extreme sensibility of tissues occurs in human beings. For this highly sensitized condition in animals is only obtained by most intense concentration of susceptible strains, a thing which never could occur in man. Neither can the results of such experiments on animals be considered as absolutely transferable to human beings.

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A Course in Physiotherapy

A SECOND course in Physiotherapy will be given at Walter Reed General Hospital, Washington, D. C., beginning February 27, 1923, and continuing for a period of four months. It is open to women who have had at least two years of training in an approved school of Physical Education. For further information, apply to: The Commanding Officer, Walter Reed General Hospital, Washington, D. C., att. Department of Physiotherapy.



NEW EQUIPMENT

Acme-International Treatment Tube Stand

THE NEW ACME-International Treatment Tube Stand combines maximum flexibility with a minimum amount of adjusting mechanism and eliminates all friction points.

The tube stand is mounted on a base of heavy iron, giving a substantial rigidity to the entire unit. The upright column is high enough to assure the operator sufficient range in the vertical plane, and within this column is the counterweight for perfectly balancing the weight of the tube shield supporting arm and shield proper. The counterweight is attached to a ball bearing vertical collar by means of a specially tested cable operating on a ball bearing swivel head pulley.

Two locking handles control all movements of the tube shield supporting arm. One of these is attached to the collar, which locks the entire tube head unit at any desired height.

The other locking handle controls all movements of the shield head. A slight turn of this handle, which is of exactly the proper size and shape to enable the operator to secure a firm grip, locks the head at the desired angle. The grip handle on the outer edge of the shield head, serves as a means for conveniently manipulating the angle of the x-ray beam.

The locking handle controls a universal joint designed with a series of corrugated surfaces which prevent slipping of the shield head.

An open type lead glass bowl for a tube with seven-inch diameter bulb is normally furnished. A closed type shield of this size can also be furnished, where better protection is demanded. An open type shield suitable for an eight-inch diameter bulb tube can be furnished, but is not recommended when over 170 crest kilovolts are used.

The filter slot is so designed that filters can be inserted from either side and in any number up to six millimeters in thickness. The filters are held in place by spring pressure. This same spring pressure serves as a means of holding the cone firmly in place. A slight turn to either the right or the left will insert or remove the cone, but at the same time the special construction of the cone and the spring pressure prevent the cone becoming loosened by vibration.

Three sizes of cones are available and an opening of $\frac{3}{4}$ inch, $1\frac{1}{4}$ inch or $1\frac{3}{4}$ inch can be secured by simply changing the entire cone without any loosening of screws or clamps. There are also two sizes of cylindrical cones procurable if the technique demands these.

The tube stand is equipped with easy moving casters and can be readily moved to any desired position and then locked to the floor by floor stops on each leg of the tripod base.

The finish of the entire unit is of black enameled and polished aluminum and nickel of the usual Acme-International quality.



The Engeln New Steel Film Filing Cabinet

THE ENGELN Electric Company has recently put on the market a new accessory designed to increase the efficiency of every x-ray laboratory, a steel film filing cabinet which solves the problem of keeping x-ray films in a convenient place for immediate reference and filing.

One of the special features of this cabinet is the small two inch drawer at the top of the cabinet, which has been termed a temporary drawer. The advantage of this small drawer is obvious—exposed films are readily accessible for reference during the day as well as serving as a convenient receptacle for the entire day's exposures. The filing can thus be quickly done either at the close or the beginning of the day.

The rest of the cabinet is made up of three large drawers, which are of sufficient size to accommodate all films, including the 14 by 17 size. The films

may be filed on edge in the same manner as correspondence in an ordinary letter file.

This manner of filing makes the films very accessible with a capacity of approximately 5,000 films in the cabinet when folders are not used. If the filing system is arranged to use folders with ordinary index guides, the Engeln steel film filing cabinet will accommodate approximately 2,500 films.

Each large drawer is equipped with roller bearing suspension so that the drawer moves freely and easily. The suspension guides move in a ratio of two to one when the drawer is open, so that the filing drawer is securely held when fully extended. This action braces the open drawer against all weight and strain.

The mechanical construction of these files is the very best that can be obtained. The cabinet is welded throughout, eliminating the usual bolt and rivet

found on inferior types of cabinets. The back is solid and welded into place. The large drawers are interchangeable and may be removed easily by slightly raising the drawer. The cabinets are finished in olive green enamel and the handles and ticket holders are pressed from solid bronze and given a satin finish. The overall dimensions of the cabinet are 20 $\frac{1}{8}$ by 26 $\frac{1}{16}$ by 56 $\frac{3}{8}$. Each filing drawer has a clear filing space of 17 $\frac{1}{2}$ by 4 $\frac{3}{4}$ by 24 inches.

The efficiency and value of this system of filing films is obvious when one realizes what such loss would mean in inconvenience and irreplaceability. Its general appearance is attractive.

The standard steel film filing cabinet comes without lock, but the Engeln Company will be glad to furnish these cabinets with a special four drawer, automatic lock, of the "push button type" and designed so that all drawers will lock independently of each other when tightly closed.



ABSTRACTS *and* REVIEWS

Appositional Growth in Crown-Gall Tumors and in Cancers. Erwin F. Smith, Sc.D., *Chief of the Laboratory of Plant Pathology, Bureau of Plant Industry, United States Dept. of Agriculture, Washington, D. C.* *J. Cancer Research*, 7:1, January, 1922.

A PLANT tumor was induced in a young tobacco plant by introducing the Paris daisy strain of *Bacterium tumefaciens*. Later examination of sections of the plant tumor so induced revealed "what cancer specialists have called conversion of normal cells into tumor cells by apposition, that is, by contact of the diseased with the normal, the 'shoal' proving to be a 0.5 mm. wide layer of cells intermediate in character between the normal cortex-cells and the tumor-cells." In this type of tumor growth there is continual "peripheral extension of the tumor farther and farther into the cortex by conversion of the adjacent normal cortex-cells into tumor-cells. One cortex-cell may give rise to a hundred or more tumor-cells."

Twenty-eight plates portray the histology of this particular tumor.

A large part of the original paper is taken up with a review of the literature of Ribbert, Borst, Virchow, Hansemann, Hauser, Krompecher, Peterson, Mentrer and others as it pertains to theories on the origin of cancer.

"What resemblance, if any, the phenomena here described may have to peripheral growth in animal and human cancer must be left for the oncologists to determine. As we have seen from the statements cited in the first part of this paper, students of cancer are poles apart in their views as to how primary cancer grows in tissues of its own type, but it will be observed that there is a wide difference in the value of the two kinds of statements, since the one kind are affirmations based on observations, while the other are denials based on inability to see. * * * In this connection it might be well to remember that when a man approaches a problem with a preconceived notion he is often blind to the plainest phenomena. Every experimenter knows this from his own observation and not infrequently from his own experience. One of the important things to be settled, it would seem, is whether anything like what I have here described occurs in human cancer. Hauser, Hansemann, et al.,

say it does; Ribbert, Borst, et al., say it does not. If it does occur, then it is one of the strongest evidences pointing toward parasitism, and it does not need to occur always to be important, nor need it be in any way confused with invasion, which is the entrance of the cancer cells into tissues of other types where in general no claim is made that there is any growth by apposition."

Cancer of the Mouth. Joseph C. Bloodgood, M.D., *Northwest Med.*, 21:280, September, 1922.

ORAL hygiene and proper care of the teeth are the great preventives of cancer of the mouth.

The author advocates early surgical removal, and though there is always room for doubt regarding the ultimate outcome, he believes that there will seldom be any recurrence if the operation is done properly and early in the history of the case. The glands should be removed if the lesion is carcinomatous. He would not use radiotherapy alone in the early cases, but advocates its use in conjunction with surgery. He says of radiotherapy that "the chapter on the use of radium and x-ray in the glands of the neck can not yet be written upon facts, only upon hope, but it seems to be that a chapter on the attitude toward a lesion on the lower lip has been written and is conclusive."

Far advanced cases are usually hopeless, only a ten per cent cure can be claimed for surgery in these cases, and the author advocates radiotherapy for these.

Cancer of the Tongue. William Seaman Bainbridge, M.D., *J.A.M.A.*, 79:1480, October 28, 1922.

INACCURATE diagnosis is many times responsible for fatal neglect of carcinoma of the tongue and just as often leads to wrong treatment, e. g., syphilitic lesions have been sometimes diagnosed as cancerous lesions. The most painstaking and capable pathologist is sometimes apt to be in error, and careful correlation of methods of diagnosis is necessary in arriving at the truth.

Except to advise radiotherapy as a palliative in hopeless cases, no direct statement is made regarding it, although the writer in his case report cites two instances where the severity of the case increased after x-ray therapy had been employed and thus indirectly he discourages its use in these lesions.

X-ray Examination of Mastoids. Floyd D. Rogers, M.D., *J. S. Carolina M. A.*, 18:309, October, 1922.

THE x-ray is useful not only to determine whether the mastoid is involved in suspicious cases, but to determine the distribution and arrangement of mastoid cells, which will be found to differ not only in different individuals, but on the two sides of the same individual.

"The roentgenologist can answer very accurately the following questions: position of the lateral sinus; the size and shape of the mastoid; whether the mastoid is completely sclerosed, or whether the sclerosis is evident only about the canal with open cells posteriorly; whether one mastoid is sclerosed and the other normal; the amount of destruction of cellular structure; and in acute conditions whether or not the mastoid is hyperemic."

The Roentgen Ray in Tonsillar Disease. Francis L. Lederer, M.D., *J.A.M.A.*, 79:1130, September 30, 1922.

A FAIR trial of roentgen ray treatment of tonsillar disease is being attempted in this author's clinic. The treatment is being carried out entirely by experts.

So far no very marked effects of treatment have been observed, but an exhaustive report is being contemplated after sufficient data have been gathered.

Carcinoma of the Larynx Treated Locally with Radium Emanation. Otto T. Freer, M.D., *J.A.M.A.*, 79:1602, November 4, 1922.

THE nature of radium emanation is briefly discussed and "curie" and "millicurie" defined. The method of collecting the emanation is briefly described and there is described an apparatus, perfected by the author, for intralaryngeal radiation by radium emanation. The technique of treatment is also given.

Results of treatment and prognosis are discussed and this is followed by a clinical report upon 32 cases of the larynx treated according to the author's method. He says: "My experience has confirmed my opinion that emanation irradiation used as described is the best existing treatment for carcinoma of the larynx; in spite of possible recurrences. The successful re-irradiation of recurrent growths has made the outlook in regard to them unexpectedly favorable."

A Preliminary Report on the Treatment of Carcinoma of the Esophagus with Colloidal Selenium. Elmer E. Freeman, M.D., Boston M. & S. J., 187:727, November 23, 1922.

IN HIS discussion of diagnostic methods the author says that clinical history, physical examination and special methods must all be utilized in conjunction with the x-ray, although "a careful x-ray study offers more in the way of diagnosis than does any other method of examination." To this statement he adds, however, that x-ray examination cannot replace endoscopy, and in spasm of the upper or lower end of the esophagus the latter is the most useful method.

The only technical point mentioned in direct connection with the x-ray examination is that the esophagus must be empty of food before the x-ray examination, else a patulous condition may lead to a diagnosis of obstruction.

X-ray Treatment of Apical Abscesses. Louis Henry Levy, M.D., Dental Cosmos, 64:1189, November, 1922

PRESERVATION of a tooth affected with apical abscess requires the most exacting care as to antisepsis and canal fillings, and even then failure is apt to result. Hoping that he might find a means of improving this method of treatment the author made a study of the effects of x-ray radiation used in conjunction with root canal sterilization and filling together with mouth prophylaxis. Results are more than gratifying. He reports: "After one treatment sinuses have cleared up, the discharge from the root canal diminished and in following treatments this has entirely disappeared. * * * The roentgenograms show that the abscessed cavity begins to become smaller with the second treatment. The number of treatments for closing up the cavity vary from two to five and are given a week apart. A complete closing up of the cavity depends upon not only the proliferation of new granulation tissue, but also on the absorption of the cavity contents." No claim is made that the rays are bactericidal, but the indirect effects are.

The technique used was as follows: Spark gap 7 inches, about 100 kilovolts (crest value measured by the sphere gap), 5 milliamperes; target skin distance, 10 inches; filter, 4 mm. Al. The time varied from two to two and one-half minutes for the sensitive skin to three minutes for the average skin. This was for the first treatment; subsequent treatments were somewhat shorter in duration. Three minutes was the longest time and one and three-fourths the shortest.

The Incidents of Thymic Enlargement Without Symptoms in Infants and Children. Roy M. Greenthal, M.D., Am. J. Dis. Child., 24: 443, November, 1922.

THYMIC enlargement was diagnosed in 90 cases or four and one-half per cent of 2,000 consecutive patients admitted to the hospital. Of these 90 cases 87 gave no symptoms and presented no history of thymic enlargement.

Diagnosis of thymic enlargement was confirmed by percussion signs, by roentgenography of the thorax, by the disappearance of the shadow after exposure to x-ray treatment and by necropsy. Enlargement of the thymus was noted in 25.6 per cent of all patients of whom a roentgenogram of the thorax was taken. The author found that cases with congenital defects and malformations seemed more apt to have thymic enlargement than did others.

He also found that in all cases where there were no symptoms of status thymico-lymphaticus, but with roentgenographic evidence to the contrary, that the roentgenographic findings were usually verified either by reduction of the tumor upon x-ray treatment or by necropsy later.

In a number of sudden deaths following operative procedure the author found a "thymolymphatic constitution," and while this may have been purely a coincidence, he advises pre-operative radiation of the thymus in all cases even where there is no suspicion of thymic enlargement.

The infant's reaction to illness may often be dependent upon the thymic condition. A number of cases of severe reaction to various illnesses in infants of a "thymic constitution" are cited and the author arrives at the conclusion that the mortality rate of infants and children, of operative cases, and of some illnesses, could be lowered by thymic treatment even when there are no signs of thymic hyperplasia.

A.M.P.

Roentgen Studies of the Thoraces of the Stillborn and Newborn. Wm. A. Evans, M.D., Am. J. Roentgenol., 9:613, October, 1922.

IN CASES of asphyxia of the newborn respiration may be entirely absent, although heart beat is present, or it may be impaired. To discover the basis of faulty respiration in these cases the author made an x-ray study of the chests of stillborn and of newborn infants.

One interesting fact is that several of the plates showed the tracheal shadow throughout, thus negating "Mink's contention that the fetal air

passages are collapsed and that the glottis and nostrils are closed."

Insufflation was tried in several cases of faulty respiration but the author decided that this method had no merit and had the disadvantage of widely distending the stomach and intestines.

A large thymus shadow was always present in a case of faulty respiration but the reverse condition was not found true.

Non-expansion of the lungs was noted in many cases and in all cases of unilateral non-expansion the lobe of the thymus on the affected side showed the greater enlargement.

Deformity of the cardiac outline was noted in several cases of faulty respiration but study of this condition is not yet sufficient to warrant the classification of such deformities although a disturbed circulation is thought to be a factor in the faulty respiration.

Fundamental Principles of Radiation Therapy with Clinical Results Possible. A. F. Tyler, M.D., Nebraska M. J., 7:370, November, 1922.

THE fundamental physical and clinical problems of radiation therapy are touched upon and the relative value of surgery and radiation therapy is discussed. Radiation therapy is decidedly advocated in cases of cancer of the lip and in those of the cervix uteri. In his comparison of radium and x-ray as to their physical nature and the effects, the author emphasizes the necessity of using x-ray as well as radium in the treatment of pelvic cancer. Radium alone in such cases can not accomplish the end sought.

In discussing the clinical effects and results the author says: "Massive carcinoma of the pancreas, of the stomach, and of the pelvis are reduced within a few days time to a size which is not palpable. * * * I have repeatedly seen malignant masses the size of a coconut reduced one-fourth in size within twenty-four hours after the first treatment had been administered. Sarcomas respond with even greater rapidity than carcinomas." Eight case reports of diverse lesions are submitted.

Nausea is reduced to the minimum by the following method: The patient is hospitalized twenty-four hours before radiation treatment is begun and an alkaline cathartic is given. The patient is kept quietly in bed during this time, only a liquid diet is allowed, and thirty grains of sodium bicarbonate is given every three hours. Radiation treatment is stopped as soon as nausea manifests itself and is not resumed until the next day when as a rule the patient can stand a longer period of treatment. Action on the tumor is just

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as effective as would be the administration of radium for a longer period, and the general condition of the patient is much better than it otherwise would be.

Intensive Deep Roentgen Irradiation. J. Henry Schroeder, M.D., J.A.M.A., 79:1240, October 7, 1922.

"MY OBSERVATIONS are based upon a series of 100 intensive deep roentgen irradiation doses that I have applied since therapeutic apparatus for this purpose has become available in this country."

A voltage of 200,000 to 220,000, Coolidge deep therapy tube, copper filters from 0.5 to 1 mm., an area of 20 by 20 cm., and a distance of from 50 to 80 cm. were used. The Wintz erythema dose was used.

The author's summary is as follows: "(1) Large doses of intensive deep roentgen irradiation with ultrahard rays, with proper precautions have been administered to patients who were not cachectic. (2) The general systemic effect, is, under these conditions less distressing than formerly, after irradiation with the soft rays. (3) The immediate effect on the blood and blood-forming organs is marked, but restoration begins as a rule within a week after the irradiation in noncachectic cases. Hemorrhages from internal malignant growths ceased; this result alone is of immediate benefit to the patient. (4) The immediate effect of therapeutic doses on the deeper organs in irradiated areas is that of irritation, and probably corresponds to a surface erythema. Glandular tissues may be destroyed. (5) In noncachectic patients, a surface erythema from these ultrahard rays was safely produced when necessary. It must be attained whenever a malignant mass near the surface is to be treated through one area of entry. (6) The iontoquantimeter permits the administration of the desired and known depth dose, and is the basis of scientific deep roentgen therapy."

The Effect on the Metastatic Tumors of the Primary Tumor. W. Baensch, M.D., Fortschr. a.d. Geb. d. Roentgenstrahlen, 29:499, June, 1922.

SMEIDEN found that receding changes following irradiation of the primary tumor were not confined to the primary growth but were noted in the metastatic nodules as well. To verify these observations the author made a special study of a number of cases in the Payr clinic.

He found that in hematogenous metastasis arising from a primary carcinoma of the rectum and found in the liver and spinal column that the metastatic lesions were not influenced by heavy successful irradiation of the pri-

mary tumor but on the contrary some of them showed increased growth and dissemination. He therefore concludes that a hematogenous metastatic tumor must be subjected to the same quantity of irradiation as is the primary tumor.

The author had three cases of carcinoma of the face with typical submaxillary metastasis, one carcinoma of the bladder with inguinal gland involvement, and two carcinomas of the breast with axillary involvement. In these cases the primary tumor was subjected to heavy irradiation while the metastatic nodules were well covered with lead. With the resolution of the primary tumors there were simultaneous resolutions of the secondary metastatic lesions. The author's explanation of this is that in these tumors the lymphatic tissue was sufficiently powerful to destroy the weak carcinoma cells, providing the primary source of supply was cut off.

A.M.P.

The Effect of the Size of Radium Applicators on Skin Diseases. Edith H. Quimby, M.A., Radium Research Laboratory, Memorial Hospital, New York City. Am. J. Roentgenol, 9:671, October, 1922.

THE author's summary is as follows: "(1) A method is outlined for determining the intensity of radiation from any applicator, in terms of the intensity from a point source of the same strength. (2) General curves are given for tubular, circular, square, and rectangular applicators, for filters of 0.0, 0.16, 0.50, 0.75 and 2.0 mm. of brass. (3) Several examples are worked out to illustrate the uses of these curves. (4) A table is calculated from the curves for obtaining the intensities of radiation from about 100 definite applicators, at several definite distances, in terms of the intensity from a point source of the same strength at a distance of one centimeter. (5) Doses in millicurie hours are given for applicators having filtration equivalent to 2 mm. of brass and 2.4 mm. of rubber. (6) Doses for different applicators, clinically determined at the Memorial Hospital, are shown to check the calculations and curves of this paper.

Protection to the Operator from Unnecessary Radium Radiation. Albert Soiland, M.D., Am. J. Roentgenol., 9:683, October, 1922.

TOO many workers are careless in their handling of radium element partially screened by metallic containers. Radium containers should be left "severely alone" except when handling them is absolutely necessary.

Protective measures must be painstakingly thorough if they are of any real value. A little carelessness may produce serious consequences. Adequate protection is possible and from now on workers themselves are to blame if untoward consequences result to themselves.

In the writer's laboratory body screens having a curved surface are used and long forceps are employed to handle the radium element whenever possible. Lead blocks are used which are perforated to hold the needles, only the eye being exposed. All accessories for handling the radium are prepared beforehand to lessen the time of contact. When adhesive which has been used in making the radium application is to be removed, simply dropping the mass into a cupful of benzine will facilitate removal of the adhesive and shorten the time of exposure.

Varicus protective devices are procurable from all dealers in x-ray apparatus and there is no longer any excuse for workers exposing themselves as once was necessary.

Where large quantities of radium are used daily there should be an alternation of workers from month to month, and a tabulated blood count of all workers should be kept.

Effects of the X-rays and Radium on the Blood and General Health of Radiologists. George E. Pfahler, M.D., Am. J. Roentgenol., 9:647, October, 1922.

DR PFAHLER cites the known cases of death from direct or indirect exposure of radiologists and their assistants to radium and x-rays. The investigations of workers both here and abroad are reviewed.

Dr. Pfahler concludes as follows: "(1) Undue exposure to the x-rays or radium is associated at times with a moderate leukoplakia, a relative lympho-cytosis, a relative polycythemia, and occasionally an eosinophilia. (2) A low blood-pressure, which does not seem to be associated with any other definite symptoms is quite common in radiological workers. (3) The asthenia, sometimes noted, can probably be accounted for by strenuous work, caused by the great interest and also by the desire to meet the heavy "overhead" charges which must be carried by the radiologist. These symptoms are also probably caused by close confinement, lack of fresh air, and lack of recreation. (4) The skin changes found in the earlier workers are not increasing, and are being avoided entirely by the younger ones, because of increased knowledge and increased protection. (5) Complete protection can undoubtedly be obtained. It requires not

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only the means, but continual caution on the part of the individual. (6) Increased protection is needed by those who are working with the gamma rays, or with the higher voltage x-rays. (7) A dental film carried in the pocket for two weeks will give a quick index of excessive exposure. If definitely fogged or blackened, protection should be increased. (8) Shortening the hours of work and increasing the amount of fresh air and recreation will probably remove symptoms, and prevent future trouble."

A Plea for Closer Relations Between Cardiologist and Roentgenologist. Pedro Ramos-Casellas, M.D., J.A.M.A., 79:1406, October 21, 1922.

DIAGNOSIS of cardiac lesions by means of the x-ray alone should not be attempted, but "few internists now call the cardiac examination complete until an accurate measurement of the heart's silhouette has been made."

The French school uses fluoroscopic methods alone. The American school uses the plate in addition to the fluoroscope.

The purpose of this article is to show "in a general way, how much information can be furnished to the cardiologist by careful tracings on a cardiogram." Roentgenologic findings must, however, be cautiously considered because of the variable factors involved.

Cancer from the Viewpoint of the Pathologist. H. H. Plowden, M.D., J. S. Carolina M. A., 18:301, October, 1922.

A CHARGE brought by the writer is that much of the physician's ignorance of the subject of cancer is due to the "chaotic condition of the literature upon the subject." There is need "for a book of ready reference, of convenient size, giving in succinct and available form a summary of knowledge concerning the subject, and the next rational procedure should be the undertaking of such a task by a man of the medical profession whose standing is secure, whose reputation is national and whose word is truth."

The original paper contains a brief discussion of the distinctions between benign and malignant tumors.

Delay in the Treatment of Cancer. Charles E. Farr, M.D., Am. J. Med. Sc., 164:742, November, 1922.

IT IS claimed by the author that poor medical advice all too frequently is responsible for deferred treatment of cancer cases. He maintains the correctness of this charge by relating an investigation instituted several years ago

by the first surgical division of the New York Hospital and recently carried further.

At the time of the first investigation one of the leading medical journals of the country refused to publish the data then secured, saying that they cast a reflection upon the profession of medicine; however, another leading paper did publish them.

The author says in his present communication: "It must be remembered that the facts were obtained by many different men, working in ignorance of any desired goal, and that the tabulations and comparisons have been made by still other men, selected for their special knowledge and training, but not the responsible surgeons in charge. * * *

Inaccuracies naturally will creep into such a compilation, but we trust and believe that we have approximated the truth. Our findings are that a delay of approximately one year occurs in the average case before adequate surgical care is sought. This means a delay after the development of symptoms or the appearance of a growth."

In summing up the investigations he says: "One hundred and fifty cases gave time lost after symptoms developed and before consulting a physician from no time to ten years. Average time twenty-four weeks."

Time from consulting a physician to time of entering a hospital was obtained in 141 cases. "It ranges from no time lost to nine years. With one exception all who waited over one year were cases in which the physician gave wrong advice. * * * Sixty-eight entered the hospital within one month from the time of consulting a physician. * * *

"Time from onset of symptoms to time of entering hospital in those cases in which it was not stated when the physician was consulted, 90 cases, excluding those given above."

He tabulates his data thus:

	Physician's Advice:		
	Total	Right	Wrong
Number curable	43	32	11
Probably curable	24	13	11
Incurable	83	39	44
Operable	74	51	23
Inoperable	76	33	43

Salt Solution in Radiation Sickness. E. Schlagintweit and H. Sielman., Klin. Wchnschr., 43:2136, October 21, 1922.

THESE authors believe that radiation sickness results from a disturbance of the sodium chloride metabolism. The salt concentration in the serum falls rapidly after radiation, remains on this level for a few hours and slowly returns to normal. Due to this change there occurs a change in the osmotic pressure bringing about the syndrome of radia-

tion sickness. It is suggested that this condition be remedied by supplying the necessary quantity of salt.

The authors treat radiation sickness by injecting 300 to 1000 cc. of physiological salt solution per rectum, or 5 to 10 g. per os, or 1.0 g. in five per cent solution intravenously. It must be administered slowly.

This treatment always proved to be successful. About fifteen to twenty minutes after the injection, especially in the intravenous method, marked improvement was noted. Nausea and vomiting ceased and patients asked for food. There can have been no possibility of a psychic effect as the patients did not know the object of the injection.

The authors recommend this treatment most enthusiastically.

A.M.P.

Treatment After Irradiation with Roentgen Ray. Joseph K. Narat, M.D., J.A.M.A., 79:1681, November 11, 1922.

THE general and the local after treatment are both considered. The author's own summary is given as follows: "(1) A roentgen toxemia appears insidiously, but nevertheless may cause serious disturbances and even roentgen cachexia. To avoid it, the roentgen technique ought to be accommodated to the general condition of the patient. (2) A renal function test should be made before irradiation. (3) Plenty of water by mouth, protoclysis, hypodermoclysis, mild cathartics, diuretics and blood transfusion eventually, preceded by venesection, help to dilute and eliminate the toxic material. (4) Irritating drugs should not be applied to the skin for three weeks after irradiation."

Postmortem Radiography. James A. Honeij, M.D., Boston M. & S. J., 187:545, October 12, 1922.

POSTMORTEM radiography is urged as a routine procedure in all cases where the cause of death is questionable. "A large amount of labor would be saved, a record of pronounced value obtained, and corroborative evidence had which the coroner could use with effect in presenting evidence in court in medico-legal cases. * * * Here is a field, apart from its more practical aspects, for research that has not been touched and which, to my mind, may give results which cannot as yet be overestimated."

Dangers and Limitations of X-rays and Surgery. C. F. Hegner, M.D., Colorado Med., 19:206, October, 1922.

ABSTRACTS AND REVIEWS

THE roentgenologist must be an expert technician, physiologist, excellent anatomist, and a thoroughly qualified pathologist, and he must be of such a temperament that he will cooperate wholeheartedly with internist and surgeon. His value as a consultant depends upon the degree of his possession of these qualities.

Use of the x-ray is absolutely requisite in all cases of fracture. The misinterpretation of shadows may sometimes result in a diagnosis of a non-existent fracture, and displacement of fragments may be so distorted on the plate, especially with careless or improper technique that pernicious surgical activity is thereby instigated.

Clinical symptoms are too often disregarded by the roentgenologist. "Cocksureness" on the roentgenologist's part leads to disparagement of his specialty. "X-ray should always be used whenever and wherever possible, not as a crutch for a weak clinician to lean upon, nor as a makeshift for the careless, but as a corroborative aid and check on other diagnostic data."

In malignancy the writer believes that operation should be the first procedure in all operable cases and that it should be followed by prompt radiation.

The Roentgenologist and the Urologist in the Diagnosis of Renal Disease. F. Granville Crabtree, M.D., and William M. Shedden, M.D., *Am. J. Roentgenol.*, 9:362, October, 1922.

TWO purposes must be kept in mind in routine examination of the kidney and ureters, namely, to show suspicious densities and to estimate the normality or the abnormality of the size and position of the kidneys.

Any x-ray examination which does not show definite outlines of the kidney shadow is unsatisfactory.

Tumors, stones, infections, stasis or any combination of these comprises, briefly, the clinical pathology of the kidney.

Tumors may be shown by enlargement of the kidney shadow or by its deformity from pressure. Tumors of the kidney may arise in either the upper or the lower pole and they may become very large without producing further deformity than in the upper or the lower calices. Papillomatous growths are difficult to diagnose. All the other forms of kidney tumor, and retroperitoneal growths in particular, are apt to carry the kidney and ureter out of position. Polycystic kidney is usually indicated by elongation of the pelvis and calices. Enlargement of Riedel's lobe of the liver may deform the kidney by compression and so be mistaken for kidney tumor.

In cases of stone attention should be centered upon the kidney rather than the stone. The thing of first importance is to ascertain whether the kidney itself is worth an attempt at preservation and whether its mate can "carry on" alone. The guide here is the nature and extent of the dilatation. Without these data no operation should be performed, nor should the stone be removed and an embarrassed kidney be left to function as best it may when proper treatment and care could relieve it of unnecessary work.

Infections are of either the pyelitis type (colon bacillus), staphylococcus type or tuberculous type. Stricture, aberrant vessels, congenital malformation or a sagging kidney may be a factor in kidney infections.

Abscess in the cortex or the pyramid is not always recognizable by means of x-ray. However, an abscess cavity which can be filled with injected material or a swollen papilla encroaching upon and flattening the neighboring calyx can be demonstrated on the plate.

Irregular glandular calci of the kidney leads to a suspicion of tuberculosis but most tuberculous kidneys do not show calcification but irregular extensions of the injected material, outside the line of calices, may sometimes be demonstrated.

Stasis is classified as acute, subacute, intermittent and relative. The first type may arise from swelling due to acute disease, from a stone passing down the ureter or from a blood clot. The commonest form of the second type arises during pregnancy. The third type is perhaps of commonest occurrence and is usually accompanied by a sagging kidney but a low kidney and crooked ureter should not be taken as the cause of the stasis unless confirmed by the cystoscope. The fourth type is found in those kidneys which show little effects of back pressure through flattening of the pyramids, yet the pelvis and the whole of the ureter and its orifice are dilated, which condition is so far inexplicable.

In making an x-ray of the ureter the patient will be much more comfortable if the pelvis is completely emptied of fluid before the catheter is introduced. It should not be expected that kinking of the ureter can be demonstrated by x-ray if a stiff catheter is passed into the pelvis of the ureter, it must first "be pulled down to the brim of the bony pelvis" when the ureter can be injected and the kinks then can be demonstrated, if they exist.

If kidney shadow is persistently absent then one must suspect a nephrectomy, a congenitally small kidney or else a congenitally malposed one; or

hydronephrosis may account for the absence of shadow. In the last case the cortical substance is so extremely thin that the shadow may not show. If in a gastro-intestinal examination no definite kidney shadow is seen but the bismuth filled intestines seem to be pushed away from the kidney region then hydronephrosis should be suspected.

The writer especially emphasizes the fact that a bilateral pyelography is necessary and that cystoscopic estimation of the capacity of the pelvis should also be made.

Radium Versus Surgical Removal of Carcinoma of the Bladder. B. S. Barringer, M.D., *J.A.M.A.*, 79: 1504, October 28, 1922.

THE work upon which this report is based covers the period from December, 1915, to January, 1922.

Both operable and inoperable cases have been treated, some by radium alone and some by operation followed by radium.

A number of the patients in each of these groups have remained free from recurrences for varying periods and the results from radium treatment are considered favorable enough to continue this method. More accurate dosage and application has been developed as a result of experience along this line and better results are hoped for in the future.

For the past three years the author has applied radium to the base of the tumor through a suprapubic opening of the bladder in cases where the growth was too large to be treated intravesically.

Radium Therapy with Special Reference to Diseases of the Female Pelvis—A Rejoinder. Howard A. Kelly, M.D., *Therap. Gaz.* 46: 761, November, 1922.

THIS is a very lively, if belated, rejoinder to one for whom the author professes his personal attachment and esteem.

Among the lesions benefited, if not cured, by radium, Dr. Kelly enumerates lymphosarcoma and angiosarcoma of the nasopharynx and of the whole body, Hodgkin's disease, leukemia, mediastinal tumors, brain tumors, primary testicular carcinomas, sarcomas of the ovary in children, and many other ailments.

Most of the article is occupied with a discussion of the results obtained by radium in cases of fibroid of the uterus, hemorrhagic uterus, cancer of the body of the uterus, and cancer of the cervix.

The writer modestly claims his own laurels as a surgeon, and pays high tribute to his specialty in general, but

he speaks in no uncertain terms his opinion of those surgeons who will not open their eyes to see what the new light of radiotherapy would reveal to them.

Of fibroid tumors he says: "He who would give his patient the same consideration he would give his wife or his sister, must put radium first in the treatment of fibroid tumors." Not all fibroids need treatment, in some operation is still the method of choice, but in some radium is just as surely preferable. The details are discussed in the original communication.

Of cases of hemorrhagic uterus he says: "At last in this emergency of the hemorrhagic uteri, when we were doing such a tremendous operation merely to check hemorrhage, radium came to our aid, and * * * presto! the hemorrhages disappeared and the patient was cured." In answer to Deaver's charge of inducing thereby an artificial menopause Kelly replies that "this condition is rarely found in young women, nor is radium used in young women until every other means has been exhausted, and when as a last resort the mutilation of hysterectomy looms up as necessary to save life, or to forefend permanent invalidism." Also he asks what is done to the function in question when the uterus is extirpated for hemorrhage.

Of cancer of the body of the uterus he says: "I have seen many women with cancer of the body upon whom it was impossible to operate and where radium was the only hope; practically every one has been benefited and here and there one is apparently cured. I still believe that surgery is the method of choice, but I am thankful where surgery is excluded to be able to use radium with so much success and the hope of a prolonged and remarkable improvement."

Respecting treatment of cancer of the cervix uteri Kelly asserts that Deaver has arrived at false conclusions by comparing data from utterly different groups of cases. Respecting Clark's data cited by Deaver the writer says: "I wrote at once to John G. Clark and asked him whether or not in his citation he had included all cancer cases in his list of radium cures, or merely those which were also favorable from an operative standpoint. He replied that the two groups were utterly diverse and not to be compared at all, that his radium cures included all cases indiscriminately. I quote from his letter of July 18th: 'You are quite right in your interpretation of my viewpoint. Of the large number of cases which we have treated for the last year or two practically none were operable, and because of the astounding good results in some of the apparently hopeless in-

stances, we have very materially decreased the number of our operations in cancer of the cervix. Indeed we scarcely operate any more in the latter cases.'"

The three groups of cases of cancer of the cervix considered from the standpoint of the radiologist are: (1) Those "with extensive lateral involvement and fixation. (2) Where the lateral infiltration is moderate and where neither side is fixed. (3) Where the disease appears limited to the cervix and mobility is not interfered with." In the first group "operation is worse than futile," radium palliates and occasionally cures; in the second group surgery should not be used for it practically never cures, radium often brings about a cure; in the third group a combination of surgery, if possible, and radium is the method of choice. Radium alone cures these cases in the last group more often than does surgery alone but neither one alone is advised if the combination is possible.

In conclusion he says: "It would take a large volume to record all the triumphs of radium. It has come to us as one of the most valuable adjuncts our therapeutic armamentarium has ever welcomed. So far as I know, no one has ever professed that it was a panacea. Exaggerations have been limited for the most part to the public press."

Tumors of the Breast. Joseph C. Bloodgood, M.D., Northwest Med., 21:338, September, 1922.

ONLY about fifty per cent of the breast cases in the author's present practice require operation, whereas in his early practice it was the rare exception to have a patient report a breast lesion before it was far advanced.

Halsted, Fenger, Senn, Warren and others of the old school had developed the sense of palpation to a high degree, unsurpassed by very few even today. This method of differentiation should be more cultivated than it is at the present time; the mere fact of lumpiness should not be taken as evidence of tumor, for there are many lumpy breasts, in fact, the average breast is lumpy without any pathology being present. Bloody discharge from the nipple should not be taken by itself as an indication of malignancy and the same is true of pain.

If inspection and palpation leave one in doubt then the exploratory operation is necessary. Every surgeon should be thoroughly familiar with the blue dome cyst and the encapsulated adenoma. If he has an absolute and certain knowledge of these two lesions then he will be safe in treating all others as cancerous.

Of x-ray and radium for breast cases the author says: "The only new problem * * * is whether you should give x-ray or radium before the operation. That problem is yet in its experimental stage." He does not say anything regarding postoperative radiotherapy other than what may be inferred from the statement just quoted.

Treatment of Recurrent Inoperable Carcinoma of the Breast by Radium and Roentgen Ray. Burton J. Lee, M.D., J.A.M.A., 79:1574, November 4, 1922.

CASES treated in the breast clinic of the Memorial Hospital during 1918, 1919 and 1920, 218 patients in all, furnished the data from which the author has drawn these conclusions: "(1) As a prophylaxis against the recurrence of breast carcinoma, a careful selection of patients for operation must be made. (2) Pre-operative and post-operative cycles of roentgen ray are important prophylactic measures against recurrence. (3) A follow-up in every patient with carcinoma of the breast operated on should be adopted as a routine. * * * (4) Properly applied irradiation to recurrent breast carcinoma definitely prolongs the life of the patient. (5) I believe that ultimately, with more complete knowledge and better technique, a still further control of the recurrent phase of this disease may be expected.

In the original paper the prevention of recurrence, results of treatment, and types of lesions for which radium is best suited, and for which roentgen rays are best suited is discussed.

The Treatment of Benign Conditions of the Pelvis with Radium. Leda J. Stacy, M.D., Am. J. Roentgenol., 9:658, October, 1922.

DR. STACY of the Mayo Clinic believes that radium "is the treatment of choice in cases of menorrhagia of menopause associated with fibromyomas not exceeding in size a four months' pregnancy, or of a fibrous uterus, in which the possibility of malignancy is eliminated by the history or by a curettement. Small doses of radium are indicated in a few carefully selected cases of menorrhagia in young women of the child-bearing age. A history or evidence of pelvic infection is a contraindication to the use of radium. In adenomyomas which are adherent and difficult to remove, the use of radium is preferable to surgery. Treatment with radium relieves the symptoms in certain cases of pruritus vulvae and in kraurosis associated with pruritus. Endocervicitis continuing after an abdominal hysterectomy responds satis-

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factorily to one or two treatments with radium."

The Treatment of Carcinoma of the Uterine Cervix. Stanley A. Clark, M.D., J. Indiana M. A., 15:339, October, 1922.

IN HIS treatment of this subject the author mentions the discouraging number of cures resulting from operative procedure and he says that from personal observation and experience he has come to the conclusion that the combined use of radium and x-ray is the treatment of choice. A brief review of the literature of the past year confirms him in his belief.

Results of Radium Therapy in Climacteric Hemorrhage. James Heyman, M.D., *Institute of Radium, Stockholm, Acta Radiologica*, 1:470, August, 1922.

THE following is a translation of the author's own summary of this article:

From 1916 to 1921 there has been treated at the Institute of Radium at Stockholm 49 cases of uncomplicated climacteric hemorrhage. All were treated by radium. Only one treatment was given in 41 of these cases, 30 were intrauterine and 11 were vaginal applications. In seven cases two treatments were given and in one case three were given.

Results: Amenorrhea was produced in 32 cases and oligomenorrhea in 16 cases. One case was unsuccessful.

The Simultaneous Occurrence of Tumors in the Thyroid, Uterus and Breast. Max Ballin, M.D., and R. C. Moehlig, M.D., J.A.M.A., 79:1243, October 7, 1922.

THE author's summary is as follows: "In a series of 200 cases (100 fibroids and 100 goiters) 53 patients or 26.5 per cent had both goiter and fibroid. Five per cent had breast tumors. (2) The age of incidence of these combinations was greatest after 35. (3) Since these three organs are not related anatomically or embryologically, the simultaneous occurrence of tumors in the thyroid, uterus and breast may be explained by their physiologic interrelationship. (4) The prophylactic treatment now advocated, of giving iodids for goiter, may likewise prove beneficial in the prevention of fibroid. (5) Perhaps certain goiters can be reduced in size or even cured by the removal of a fibroid (as suggested by Ullman)."

Th Desperate Risk Goiter. Martin B. Tinker, M.D., J.A.M.A., 79:1291 October 14, 1922.

DESPERATE risk cases are those hyperthyroid cases which have obstinate gastro-intestinal symptoms, very high blood pressure and myocardial insufficiency.

"Some will ask why we do not use the roentgen ray or radium. In the first place, we surgeons not only see the failures from these and other measures of treatment, but we see patients that are actually worse or badly burned, although treated by supposedly experienced operators. In the second place I do not believe dosage can be accurately enough controlled to avert myxedema. In the third place, having lived long enough to see the passing of various serums, injections and other cures in the hands of good men, I am willing to await permanent results. Thus far since Kocher's series of the early nineties, no method but surgery has stood the test of time."

A Simplified Pneumoperitoneum Technique. L. R. Sante, M.D., *Am. J. Roentgenol.*, 9:618, October, 1922.

STEWART and Stein advocated simplicity of apparatus and procedure in pneumoperitoneum, but their advice has been lost sight of by many of their followers, and consequences are not always all that either the operator or patient might wish.

Pneumoperitoneum to be successful must be capable of production with simple apparatus easily procurable and must be so simple that any medical man can perform it. Also it must be convenient and not require a long time for its performance, it must be safe for the patient and of the least possible discomfort to him.

The author believes that he has hit upon an apparatus and method which more nearly fulfills these conditions than any others now in use. Full description and illustration of the apparatus and technique for its operation are given in the original paper. No special apparatus is necessary and no gas tank is required. The author does not assert that his method is positively safe as regards the life and condition of the patient, but does assert that it is safer than "some other diagnostic methods employed daily by internists and surgeons."

A Clinical and Roentgenographic Study of Gastropnoxis. Seale Harris, M.D., and J. P. Chapman, M.D., J.A.M.A., November 25, 1922.

GASTROPTOSIS should be termed a physical characteristic and should not be considered as an anomaly or a disease.

The x-ray has dissipated the dictum that a normal stomach must, in every individual, occupy a certain circum-

scribed and definite location. The error of the older anatomists lay in the assumption that the stomach must always be found in the same position it is found in the supine body, that is, usually in the upper left quadrant of the abdomen, with the dome lying in the vault of the diaphragm and the lower border about two inches above the umbilicus.

Over one thousand gastro-intestinal patients were examined by this author. X-ray study has shown that there is a marked mobility of the stomach which is affected by the position and type of the individual, by the weight of the stomach, and by the tension and relaxation of the abdominal muscles.

In the slender flat-chested person, having a slender abdomen, the stomach will most often be found in the lower left quadrant of the abdomen, when the patient is in the standing position, and this location is normal for this type. Differences in the size and shape of the chest will result in all sorts of locations between this last described position and the one formerly thought to be the normal one.

A Review of 3,500 Roentgen Examinations of the Alimentary Tract. Richard A. Rendich, M.D., *Long Island M. J.*, 16:456, November, 1922.

THE larger number of these examinations were made at Bellevue Hospital. The "tabulations are made only according to radiographic findings of this tract * * * cases presenting multiple lesions are classified under that which was considered most important from a symptomatic viewpoint. Pathological processes of the respiratory, cardiovascular and other systems discovered during routine gastro-intestinal study are not included, as separate reports describing such lesions in detail were made after the necessary examination."

Haudek's double meal method was employed, a motility meal was given six hours previous to the first examination and a second observation was made twenty-four hours later and each day thereafter until the mixture had been completely evacuated.

The fluoroscope was depended upon for most of the information but plates were made for a record and for detail study whenever this procedure seemed indicated. In many cases where manipulation was necessary to demonstrate the deformity the plates were made during fluoroscopy. Repeated examinations were made in all doubtful or difficult cases.

Negative reports were given in 2,152 cases; the different lesions found and

the number of cases of these are shown in the following tabulation:

Esophagus	81
Organic Disease of Stomach.....	101
Asso. Gastric and Duod. Ulcers..	4
Gastritis	8
Carcinoma	174
Pyloric Obstruction	10
Postop. Conditions of Stomach..	79
Postop. Conditions of Colon.....	12
Organic Disease of the Duod....	183
Disease of the Appendix.....	174
Adhesions	89
Organic Disease of Colon.....	105
Functional Disturbances	100
Congenital Anomalies	16
Disease of Liver.....	28
Disease of Gall-Bladder.....	109
Extra-Gastric Conditions	71
Miscellaneous	24

Ascarides in the Gastro-Intestinal Tract as They Appear in the Roentgenogram. Otto Fritz, M. D., *Fortschr. a.d. Geb. d. Roentgenstrahlen*, 29:591, July, 1922.

Ascarides in the gastro-intestinal tract often cause no essential local disturbances, but produce general symptoms such as enteritis, colics, nausea, anemia, itching, etc., which are caused by poisonous metabolic products of the ascarides.

Due to their tendency to crowd into narrow canals and ducts, they not infrequently cause severe lesions such as liver congestions, abscesses, or obstructions. If as sometimes happens, they pass through the duodenum into the stomach, they may be observed in the vomitus or may be aspirated into the lung passages. It is therefore quite necessary after the laboratory examination has revealed the ova in the feces, to determine in which part of the alimentary tract they are found.

In two cases the author found a spiral shaped object about the length and thickness of a goose quill, once it was observed in the stomach and at another time it was observed in one of the coils of the jejunum, both times it showed up distinctly in the surrounding substance of the opaque medium.

A.M.P.

The Mechanism of the Gastric Movements in Man as Observed by Roentgen Methods. E. Egan, M.D., *Fortschr. a. d. Geb. d. Roentgenstrahlen*, 29:597, July, 1922.

CONTRARY to the usual teachings, the author found from fluoroscopic observations, that the emptying of the stomach contents is not the result of reflexes emanating from the duodenum. The opening and closing of the pylorus does not result from chemical or mechanical stimulation to the sphincter. Hyperacidity appears to act very much

in the same way, as far as opening and closing of the pylorus is concerned, as does an anacidity.

Quoting the conclusions of McClure and Reynolds that the degree of acidity has no bearing on the opening and closing of the pylorus, and the conclusions of Wheelon and Thomas that the motility of the antrum determines the motility of the sphincter, the author is in agreement with Schlesinger that the opening and closing of the pyloric ring is produced in a purely mechanical manner. Fluoroscopic observations show that in stomachs of normal tonus the pyloric sphincter is partially open even when the stomach is empty, as evidenced from the fact that the first portion of the opaque suspension nearly always passes out through the pylorus, immediately, without any hindrance. The further portions pass out whenever there is considerable contraction of the antrum. The explanation offered is that the longitudinal muscle fibers of the stomach which end in the pylorus when undergoing contraction pull the opening apart, thus allowing the ingesta to be pushed through. At the resting phase of the fibers the pull is released and the sphincter contracts again.

A.M.P.

Gall-Bladder Disease. A. Johnson Buist, M.D., *J. S. Carolina M. A.*, 18:281, October, 1922.

THE function of the x-ray in the diagnosis of gall-bladder disease is in the elimination of the stomach and duodenum as the source of symptoms. The writer claims that in only a few cases do the rays reveal gall-stones, even when these are present.

Inflation of the Colon for X-ray Examination of the Intra-abdominal Organs. A. Henszelmann, M. D., *Fortschr. a. d. Geb. d. Roentgenstrahlen*, 29:465, June, 1922.

AFTER remarking that inflation of the colon has long been used for percussion purposes, that there is no danger or discomfort to the patient from its use, and that in most cases it can replace the Rautenberg method (pneumoperitoneum), the author states he has found his method highly useful in a large number of cases. Examining the patient with the insufflated colon in various positions, and regulating the inflation according to the particular needs, many data can be obtained regarding the spleen, liver, and gall-bladder. It is especially useful in the obese, in presence of ascites, defensive-musculorum, abdominal tumors, etc., where percussion and palpation yield no results.

A previous emptying of the colon is desirable but not absolutely necessary, except where the examination is made

for the determination of the presence of stones in the gall-bladder.

The spleen can always be rendered visible by this method. If not in the anteroposterior view, it will certainly appear in the diagonal view, as it is often pressed toward the wall by the inflated colon. Slight enlargements of the spleen are easily appreciable. Cases of malarial enlargements have been diagnosed by the author after roentgenoscopic examination had shown the lungs perfectly clear.

In the examination of the right flexure the direction of the rays is of supreme importance. They should come obliquely from above downward, dorso-ventrally. By this arrangement the lower edge of the liver is thrown downward along with the gall-bladder and both the upper and the lower edge of the liver will be visible. It will then be easy to differentiate between conditions of the liver and those of the pleura, lungs and diaphragm. The mobility of the liver can be determined and growths and scirrhotic conditions can easily be diagnosed from the appearance of the lower edge of the liver.

In examining the gall-bladder the fundus of the bladder can always be thrown into the air outline by directing the rays as described above and by turning the patient. Since in the reclining position the bladder is not extended and often projects backward the author makes this examination with the patient in the standing position. A slight overdistention of the colon may be found necessary, and it is usually harmless.

The enlarged gall-bladder appears in the mammillary line as a rounded projection of the lower edge of the liver. In cases of gall-stone with a history of previous attacks inflation of the colon may occasionally bring on an attack of considerable severity and care should be taken to avoid overdistention. The visualized gall-bladder can be palpated and tenderness elicited. But when the gastro-hepatic duodenal ligament seems shortened, with the pylorus, antrum and duodenum drawn forward to the right side the diagnosis of pericholecystitis can be made.

Care must be taken not to misinterpret haustral impressions for gall-bladder. Scybala must be carefully recognized and when necessary avoided by previous emptying of the colon. The kidney pole presents a different problem. The gall-bladder is directed more outwardly, both the lateral and medial contours are definite, while that of the kidney pole is deeper, lower, larger, and has a recognizable external edge with no internal edge. In comparison with the gall-bladder it moves but slightly with respiration. A.M.P.

Does Cancer Arise in Chronic Gastric Ulcer. W. C. MacCarty, M.D., J.A.M.A., 79:1928, December 2, 1922.

FROM the author's experience with 1,400 gastric specimens he has come to the conclusion that the possibility of cancer is always present in cases of gastric ulcer, and that there are no clinical nor laboratory methods by which the differential diagnosis can be made. Most chronic gastric ulcerations with a diameter greater than 2.5 cm. are cancerous, and when the roentgenologist discovers such a finding he is practically safe in making the diagnosis of cancer. The author would not temporize in a case of chronic gastric ulcer. He divides ulcers of the stomach into five groups, namely, simple, acute, peptic ulcer; tuberculous or syphilitic chronic ulcers, the chronic ulcer whose etiologic factors are unknown, the chronic ulcer having a neoplastic process in the borders of the mucosa, and the gastric ulcer which shows carcinoma not only in the borders, but also in the base.

Roentgenological Examinations of the Motility of the Stomach in Healthy Individuals During Rest and Motion. Aage Als Nielsen, M.D., *Municipal Hospital, Copenhagen, Acta Radiologica*, 1:379, August, 1922.

TWENTY stomachs of healthy individuals were examined, 10 men, 10 women, following the intake of a meal consisting of 300 grams of rice flour gruel and 100 grams of barium sulphate. Some of the individuals examined were at rest and some in motion.

The findings were as follows: The stomach empties more quickly during motion than during rest, and under each of these conditions the women's stomachs emptied more slowly than did those of the men. Normally, with the patient at rest, the stomach emptied within five hours intake of the meal.

Carcinoma of the Stomach. Byron B. Davis, M.D., *Nebraska M. J.*, 7:365, November, 1922.

THERE are two main groups in the author's classification of this lesion. One group is composed of cases who have had a history of "dyspepsia" for a number of years before the trouble assumed a more serious aspect in their eyes. The second group is composed of those patients, generally past 40 years of age, who have had no trouble whatever in their earlier years.

The author discusses the symptoms of the disease and the value of different forms of examination with respect to diagnosis of the lesion.

A plea is made for constant propaganda regarding the cancer evil and

medical men are urged to be more thorough in their examinations and more constant in their study of improved technique and methods of examination. Increased knowledge of cancer on the part of the public is already bringing increased responsibility to the physician and the conscientious man will prepare himself to meet this responsibility.

Of the x-ray the author says: "The x-ray intelligently used and skillfully interpreted is of much value, but even this aid, if unsupported by clinical evidence, may frequently lead one far astray. * * * In every case of gastric malfunction, whether it points toward cancer or not, I believe the x-ray should be made use of, but I strongly protest against drawing definite conclusions from the x-ray alone."

Reports of the First Bilingual Congress of Radiology and Physiotherapy—(Continued; Six Abstracts). Discussion on Deep Therapy, Concluded. *Arch. Radiol. & Electroth.*, 27:98, September, 1922.

DR. VILVANDRE in his discussion advocated pathological as well as clinical diagnosis in connection with x-ray examinations and also advocated surgery whenever possible. He complimented the French upon their excellent work along the line of biological research as it applies to radiotherapy.

Dr. J. Owen Harvey emphasized the need of better technique in the use of homogeneous radiations of short wave length and the need of research along this line.

Dr. Martin Berry declared himself a disciple of Dessauer's system of measurement of dosage.

Professor Sidney Russ discussed the three variables present in the problem of radiotherapy. These are: (1) radiation, (2) tumor sensibility, (3) body resistance. He said that as a physicist he considered the present achievements in radiotherapy quite wonderful in face of the intricacy and mystery of its laws.

Of tumor sensibility he said the following: "Now, how great is the range of tumor sensibility? Is one tumor three, four or five times as sensitive to the measured dose of radiation as another, or has it a smaller factor? By this method, simple, of course, as a side issue, but nevertheless rather an illuminating one, we have so far carried out investigations on between 50 and 60 cases of malignant disease * * * cases of very considerable variety, sarcomas and carcinomas. * * * This tumor material, of varied histological type has all been given exactly the same dose of radiation * * * a quantity we call twice the lethal dose. You will quite understand that there was a difficulty about doing this in the human

subject. It was decided to employ a factor of safety or two. All of these different types of tumors have had a dose of radiation corresponding to twice the lethal dose of the normal tumor, and of these 55 cases to date not a single case has grown. In this way the experiments might prove a useful contribution to setting the limits of x-ray action."

Dr. N. S. Finzi said that the Dessauer tables, while accurate for water, are not accurate for the human body, that the Dessauer method had the further disadvantage of exposing a very large total area of tissue to maximum radiations, and that even though a large area of skin is exposed in using this method there is, nevertheless, danger to the skin.

Sir Archibald Reid protested strongly against preoperative raying, as he believes the delay so caused is dangerous and the value of the procedure questionable.

Dr. F. Hernaman Johnson said that the reaction of surrounding tissue and of the body as a whole was to his mind a matter of great importance. Some way of raising the general resistance of the body before giving massive dosage is one of the great needs of radiotherapy.

On Penetrating Radiotherapy by X-rays and Radium. Robert Proust, M.D., *Paris, Arch. Radiol. & Electroth.*, 27:121, September, 1922.

DR. PROUST limits his discussion to his own personal experiences of Curietherapy and radiotherapy at the Hospital Tenon and to the deductions arrived at through these experiences.

He believes that the biological effect of radiations is more dependent on their quality than on the dose absorbed, and he believes that the future of radiotherapy is bound up with the possibility of obtaining x-rays of shorter and shorter wave length.

Editorial Comment Upon Congress of Radiology and Physiotherapy, Section of Electrology. *Arch. Radiol. & Electroth.*, 27:129, October, 1922.

DR. W. J. TURRELL and MM. Challiol, Laquerrere and Bourguignon voiced the opinion that all the physiological and therapeutic effects of direct current are due to ionic movements. Reasons were given "for believing in the occurrence of chemical rearrangements at the sites of virtual poles in the tissues in the path of the current between the skin electrodes."

Dr. Bourguignon described his "method of muscle and nerve testing by

condenser discharges and the determination of the chronaxie by this method." Editorial mention is made of Dr. Bourguignon's great labors in research along this line, from which far reaching results may come.

"The success of this section of the Congress justifies the hope that this is the first of a long series of such meetings, as they enable us to discuss our subject with friends and colleagues whose geographical separation from us causes the paths along which our work progresses to diverge from theirs at many points."

The entire October issue of the *Archives* is taken up with the papers read at the Section of Electrolgy. In addition to papers by those mentioned above there is one by MM. Menard and Foubert, which advocates abdomino-thyroid galvanization as the best method of treatment of symptoms of Basedow's disease. Another paper by MM. Ronneaux and Laquerriere is entitled "The Physiological and Therapeutic Action of High Frequency Currents" and takes up the general applications of medium tension, diseases of the circulatory apparatus, general applications of low tension and great quantity, applications of high tension, and physiological action, and the therapeutic applications of currents of resonance or of high tension. The last paper of the series is by M. S. Nemours-Auguste and is entitled "Pyloric Spasm and Painful Abdominal Cases Treated by High-frequency Thermo-Penetration." Four case reports by M. Bonnefoy are appended to this paper. Two of these were cases of tubercular ulceration cured by applications of the high frequency current, one other was a case of fistula following appendectomy, and the fourth was a case of swollen and painful breast, diagnosed adenoma. The fistula is reported completely cured and the breast swelling was reduced and the pain relieved.

Considerations of Curietherapy of Cancer. Simone Laborde, Chief of the Radiological Laboratory of Cancer Therapy in the Hospice Paul Brousse, Villejuif, Arch. Radiol. & Electroth., 27:114, September, 1922.

A REVIEW of the well known biological, technical, and clinical facts of radiotherapy is first given. This is followed by a discussion of biological, technical and clinical points which are as yet either obscure or disputed. The discussion covers the quality of rays in relation to their therapeutic effect, the distribution of rays, radiotoxemia, indications and contra-indications for treatment of various lesions, preoperative and postoperative treatment, and

combined radium and roentgen treatment.

The views of leading authorities in the radiological world are constantly given place throughout this last discussion.

The author concludes by saying that the combined method of deep therapy (radium and x-rays) is of too recent date in France to form any conclusions upon the results as yet.

Cascade-Stomach. J. H. Douglas Webster, M.D., Arch. Radiol. & Electroth., 27:110, September, 1922.

CASCADE-stomach, an atypical form of hour-glass stomach, was first differentiated by Rieder. Barclay has recognized it, calling it 'cup-and-spill' stomach. Carman's view is that it is 'simply an hour-glass in which one portion of the stomach is not directly above the other, but they are shifted laterally.' But Schuetze points out that it is not an hour-glass in the usual sense (a B or X-shaped incisura or constriction), but more a drawing up of the posterior wall to such a degree, that on taking the opaque meal only the upper sac at first is visible, filling to a considerable extent before overflowing in an anterior or medial cascade to the lower sac, this method of filling being very different to the usual hour-glass; as a rule only very narrow organic hour-glass stomachs show considerable delay in the upper sac. Schuetze says a third sac has been seen, what he calls a 'cascade-waterfall,' related possibly to the very rare gastric diverticula described by Schlesinger (in a duodenal ulcer case) and others, Akerland having had a case with multiple diverticula (four or five) which I saw last year in his clinic.

"From a conversation with Barclay some time ago, I believe he regards the mechanism of cascade-stomach as a drawing up of the greater curvature by the oblique fibers to such a degree as to cause the deformity, and I believe he regards the condition as entirely spasmodic, as he has seen it present at one examination and absent at a later view of the same case."

A brief review of the literature is then given followed by two case reports and the author concludes that the whole subject requires further study before organic or spasmodic types can be clearly differentiated. It has been seen with "local lesser curvature ulcers, or adhesions; (2) pyloric and duodenal ulcers; (3) normal stomachs; (4) with extreme meteorism, especially with splenic colon gas distention; and (5) with extra-ventricular tumors."

The Normal Stomach. A. E. Barclay, M.D., Arch. Radiol. & Electroth.,

27:103, September, 1922.

DR. BARCLAY'S summary is as follows: "The normal stomach has no definite form. Its shape is subject to wide alterations within the bounds of normality. These alterations are chiefly due to changes in the tonus of the muscle. Tone is a 'posture' of muscle which is capable of maintaining a given form in spite of the action of gravity and other forces. Gastric atony (or rather impaired tone) differs from pure gastroparesis in the fact that the lesser curvature is not increased in length as compared with the normal—the converse holds good in gastroparesis.

"Peristalsis and tonic action are independent of each other, although apparently functions of the same muscle fibers. The oblique band of muscle fiber is probably responsible for taking the weight of the stomach and its contents. Experiments go to show that this band can, and probably does, act independently of the other muscular coats of the stomach."

The Roentgenogram of Acute and Chronic Bronchitis. M. F. Von Falkenhausen, M.D., Fortschr. a. d. Geb. d. Roentgenstrahlen, 29:586, July, 1922.

TWO theories have prevailed regarding the normal lung markings. The one claims that these markings represent the bronchial walls, while the other attributes them to the blood vessels. The author made a large number of roentgenograms of cases of well developed bronchitis where all possibilities of the presence of tuberculosis had been eliminated.

The hilum shadow was not enlarged, but the markings of the trunks were especially intensified, broadened, and enlarged. The branchings were also more prominent, but there was no enlargement of the twigs near the periphery. Mostly they reached out to the periphery. The trunks of the lower division of the bronchial tree had undergone most changes, and in some places adhesions to the diaphragmatic pleura were recognized, the diaphragm shadow showed angulation on inspiration. The middle and upper trunks showed less changes. In very acute conditions there can be found in the course of the subdividing trunks small dense bean-sized spots which represent small circumscribed bronchopneumonic lesions (Cases of bronchitis with rise in temperature are usually of this type—A.M.P.). Generally the changes are less noted in the acute cases than in the chronic.

Based upon these findings the author comes to the conclusion that the normal lung markings represent the bronchial walls, as the blood vessels of the

smaller circulation would not undergo such enlargement.

The author calls attention to the fact that peribronchial thickening has been described as a tuberculous lesion, and says that the picture is often found in purely bronchial conditions.

A.M.P.

The X-ray in the Diagnosis of Pulmonary Tuberculosis. Samuel W. Ellsworth, M.D., Boston M. & S. J. 187:472, September 28, 1922.

THE screen serves best in observing the movements of the thorax, diaphragm and heart during respiration. The film or plate gives a permanent record of the details of light and shade. The stereoscopic films afford perspective vision and position of shadows. The lung fields, distended with air, offer but slight resistance to the passage of the rays and present a brilliant background for the study of the more opaque tissues. The depth of the shadows cast is dependent upon the density and mass of the structures traversed by the rays. * * *

"Interpretation of x-ray films demands a careful analysis of the data observed; definite diagnosis or etiology can be made only by a coordination of the history, physical signs and symptoms and laboratory data.

"It is necessary to emphasize that x-ray observations concern not merely one spot of density but rather the entire lung fields, the level of the diaphragm, the excursions during respiration, as well as the position and movements of the heart. * * * Doubtful cases may require repeated examinations."

Mutation of Pulmonary Shadows Due to Type of Breathing. H. A. Bray, M.D., Am. J. Roentgenol., 9:628, October, 1922.

THAT the shadow of any pulmonary type of lesion remains constant and unchanged is questioned by this writer. He maintains that changes in the type and depth of inspiration preparatory to x-ray exposure produce striking shadow mutations.

He has found that "hard" shadows which some roentgenologists interpret as indicative of fibrosis and inactivity may, by a change in type and depth of inspiration, become soft shadows which ordinarily are interpreted as evidence of an active lesion. Regulation of "the extent of participation of the costal and diaphragmatic elements during the inspiratory act" results in numerous transitions in any mutation observed.

The occurrence of these shadows is "especially to be remembered in studies devoted to the correlation of the roent-

genography and pathology of tuberculosis."

A Study of the Roentgen Aspect of Tuberculosis of the Joints and Its Relation to the Clinical Aspect, Especially When Under Treatment by Universal Light Baths. Edward Collin, M.D., Copenhagen. Acta Radiologica, 1:395, August, 1922.

THE Finsen Medical Light Institute offered the material upon which this study was based. The author announces that the study is only preliminary. Twelve case histories are detailed and amply illustrated by 35 plates. The following is an abstract of the author's summary: (1) Even though the plate reveals no sign of tuberculous changes the possibility of the affection being tuberculous remains. (2) Changes may become apparent on the plate at a time when clinical symptoms are improved. (3) Even very large destructions may be impaired with treatment by light rays. (4) Complete healing may occur long after clinical symptoms have ceased. (5) Tuberculous osteitis can heal spontaneously but healing is attained more quickly and the cosmetic and roentgenologic aspect is much better if light rays are used. (6) "Simultaneously with clinical improvement considerable roentgenological deterioration is seen at times. In reality this is merely the sign of the diseased material being resorbed. (7) Extensive arthritis in hand, ankle, knee, and elbow joint can heal with new formation of articular cartilage and good function. (8) A joint end seen deformed roentgenologically can occur simultaneously with a completely free function clinically."

Results of Treatment of Surgical Tuberculosis with Carbon Arc-Light Baths at Finsen's Light Institute from 1913 to 1921. N. P. Ernst, Copenhagen. Acta Radiologica, 1:422, August, 1922.

IN Denmark, Norway and Sweden, the author states, this treatment is being employed increasingly with good results. However the results depend upon the proper technique being used and directions are given for this in the original article which covers more than thirty pages and is thus summarized:

"At the Finsen Medical Light Institute in Copenhagen on the initiative of Doctor Reyn 'Finsensbaths' (carbon arc-light baths) have been employed since 1913 for treatment of patients suffering from lupus or surgical tuberculosis.

"In all, 439 patients suffering from surgical tuberculosis have been treated, 158 cases of uncomplicated tuberculosis * * * and 396 cases of tuber-

culosis complicated with abscess or fistulas. * * * The results with treatment have been remarkably good.

"In 158 cases of uncomplicated tuberculosis in joints and bones 12 have broken off the treatment. Of the rest 122 or 83 per cent were cured (88 with free movement, 18 with partial movement, 5 without movement). Five were improved and only 19 were unchanged.

"In 396 cases of surgical tuberculosis complicated with abscess or fistulas 24 have broken off the treatment and 10 have died under treatment. Of the remaining, 332, or 91 per cent, were cured (255 with free movement, 55 with partial movement and 22 without movement). Fifteen were improved and only 25 were unchanged.

"As regards the results, one may remember that the greater part of the patients are adults, only less than one-third per cent are recruited from childhood, and further many of our patients have been ill for so many years, that *a priori* any thought of recovery had to be excluded. Furthermore it may be remembered that many of our patients on account of lack of space and much against our wish, have had to be treated ambulant, and during the treatment they have lived in their extensively poor homes.

"The best results are obtained in cases of tuberculosis in hand and foot and elbow joint, also in all forms of osteitis both complicated and uncomplicated.

"The cases which have proved refractory are the uncomplicated tendosynovitis, and the very old fistulous bone affections in columna pelvis and coxa."

Osgood-Schlatter's Disease. Ellie R. Bader, M.D., Am. J. Roentgenol., 9:623, October, 1922.

OSGOOD-SCHLATTER'S disease is due primarily to trauma and its severity varies from a subacute inflammatory thickening of the tibial tubercle to its complete avulsion by muscular contraction.

Anatomical and radiographic description follows the definition of the disease and two cases are discussed and illustrated by x-ray films.

Differential diagnosis must be made from tuberculosis, bursitis, infectious arthritis, fracture of patella, periostitis, joint fringe, and loose cartilage. The x-ray plate is the method of differentiation.

Callus Formation Without Preceding Injury. Walter Mueller, M.D., Muenchen. med. Wchnschr. 69: 1475, October 20, 1922.

DEUTSCHLANDER has observed a number of cases of callus for-

mation with no history of preceding injury. The patients, who were mostly middle aged women, began to complain of localized pain at the junction of the middle and distal thirds of the metatarsus. Roentgenograms were negative at first, but after three to four months a spindle-shaped callus was noted usually on the second, but occasionally on the third or the fourth metatarsal bone. No fracture line could be demonstrated. Deutschlander attributed this structural change to a low grade hematogenous osteitis and he believed there was even some rise of temperature in these cases. Jacobsen and Vogel deny the possibility of callus formation without preceding fracture.

The author of this paper, however, claims that callus may form not only in traumatic and inflammatory conditions, but also whenever the bone has been exposed to insult of long duration, and he substantiates his claim by experimental evidence. A similar spindle-shaped new bone formation was produced in the ulna of a dog within six to seven weeks after resection of a large part of the radius. The new bone deposits occurred just opposite the defect in the radius. The original bone tissue in the center of the callus gradually disappeared. Martin first observed this phenomenon manifested in the ulna in cases of pseudo-arthritis of the radius and he named it "sympathetic disappearance of bone."

A.M.P.

The Definite Form of the Coxa Plana.
Henning Waldenstroem, M.D.,
Hospital of St. Goeran, Stockholm.
Acta Radiologica, 1:384, August, 1922.

COXA plana essentialis" is the designation suggested by this writer for what is now called Legg's disease, Perthe's disease, osteochondritis deformans, coxae juvenilis, etc. The first names he objects to because they are the names of individuals and the last because it indicates a symptom (inflammation) which does not belong to this lesion, but to coxa plana tuberculosa, staphylomycotica, etc., from which the roentgen plate does not distinguish it during its early stage of development. A certain observation period throughout its entire development is usually necessary to establish it as a true coxa plana essentialis.

These periods and their roentgenological description are thus given by the author:

(1) Evolutionary period—this lasts from three to four years and has two stages:

(a) The initial stage of one-half to one year. The epiphysis is dense with decalcinated spots, flattened, uneven at

the margin. The collum often has decalcinated spots just near the upper part of the epiphyseal line. The articular cartilage is of normal height.

(b) The fragmentation stage lasts from two to three years. The epiphysis is extremely flattened and divided. "At the beginning it is often in three large pieces that can afterwards be divided into many small granules. Atrophy."

(2) Healing period. This lasts from one to two years. "The epiphysis becomes homogeneous. The lime returns."

(3) The growing period extends "to the conclusion of the normal period of growth. During this period the coxa plana assumes its final form."

(4) The definite stage.

SUMMARY

"The diagnosis coxa plana essentialis can with certainty be made only during the evolutionary stage. The definite form can, therefore, only be studied in cases that are followed from the beginning of the disease.

"To endeavor to explain the definite form of coxa plana I have examined those cases of coxa plana where I have been enabled to follow the development from the beginning until the end of the period of growth. There are shown to have been 22 hips; ten of these have attained an age of over 20 years.

"The definite form that I can hereby establish, is shown to be very variable in respect to the degree of the deformity, but the flattening of the caput, collum and acetabulum is common to all.

"Through roentgenograms, both from a frontal and a lateral view, one can obtain a plastic picture of the form of the caput and collum in the different cases. It can then be seen how it is mainly the anterior-superior portion of the caput that is enlarged and that this portion, in the more pronounced cases, lies outside of the articulation. With respect to the degree of the deformity I have divided the definite coxa plana into three groups: (1) The caput preserves a rounded form. The caput and collum can be well distinguished from each other and from the trochanter. (2) The upper and frontal part of the enlarged caput lies close to the greater trochanter. * * * (3) The joint surface of the caput is uneven and more or less excavated. The upper pole of the caput is edge-formed and usually lower than the summit of the greater trochanter."

Seventeen films illustrate the original article.

Bone Sarcoma: Prevalence in Massachusetts. E. A. Codman, M.D., Boston M. & S. J., 187:543, October 12, 1922.

DR. CODMAN'S attempt of the past few months to register all

cases of bone sarcoma in the present population of Massachusetts has so far yielded nine authentic cases. Twenty-two cases of giant cell tumors have also been reported.

Dr. Codman reports that the following reports have been brought out by this investigation: "Diagnosis should be made with great caution; Bloodgood's claim of the benign character of giant cell tumors (erroneously called sarcoma) is confirmed by experience in Massachusetts. True osteogenic sarcoma is almost always fatal (the rare exceptions being cases where early amputation is performed). Since only nine living cases could be located in a population of 4,000,000 there are probably only 225 in the whole United States. It certainly is not likely that there are more than double this number at any rate."

He believes that logically the x-ray may be used in a case of suspected bone tumor, for surgery has little chance if the tumor is malignant, and if it is benign delay can do no harm and cure may result from the use of the x-ray.

Editorial comment in the above journal informs us that "a unique collection of material, including histological preparations, x-ray plates, gross specimens and case histories of bone tumors from all parts of the country" have been collected as a result of Dr. Codman's investigation. "The cases of bone sarcoma already collected by Dr. Codman constitute a larger series than most pathologists see in a lifetime."

On the Roentgen Treatment of Brain Tumors. S. Nordentoft, M.D., *Acta Radiologica*, 1:418, August, 1922.

THIS is "a report of 19 cases of clinically diagnosed tumor of the brain, treated by roentgen irradiation. Probably some of them have been cyst or meningitis serosa, etc., not responding to irradiation. Nine of them seem to be cured (some of them with remaining defects, as, for instance, hemianopsia) and some are surviving; one of them two and one-half, the others from three and one-half to six and one-half years after treatment. Through the good effects of irradiation the diagnosis of brain tumor is confirmed."

High Frequency Practice for Practitioners and Students. By Burton Baker Grover, M.D., Octavo, pp. 398, illus. 95. The Electron Press, 115 East 31st St., Kansas City, Mo. 1922. Cloth, \$4.00 net.

DR. GROVER is enthusiastic upon the subject of physiotherapy but his enthusiasm is tempered, as the following sentence, quoted from the preface of this volume, shows:

ABSTRACTS AND REVIEWS

"Electrical modalities assist in rounding out the physician's armamentarium, but let us not through enthusiasm possess ourselves with the idea that the entire field of medicine revolves about the art of physiotherapy."

The physics of electricity in general, of light and of high frequency currents, with the apparatus for producing the latter, are treated of in the first 63 pages. In the next two chapters medical diathermy and surgical diathermy are defined, their general effects and the technique for their use is described.

The physiology, etiology and interpretation of blood pressure are discussed in the next chapter; the following one classifies pain into its different types and the causes of these are discussed.

A discussion of the diseases amenable to high frequency therapy is given the largest proportion of space in the book. Etiology, symptoms and technique of treatment are fully discussed. Seventy-five or more diseases and disease conditions are named for which this form of therapy is recommended.

There is much new material in this book. Forty pages are devoted to diseases of the eye and their treatment by electricity. The author wishes it definitely understood that for these conditions he is recommending electrical treatment only as an adjunct to established forms of eye therapy, nevertheless, he believes it to be a valuable and at times a very necessary adjunct to the recognized forms of therapy.

The author's address, given as retiring president of the Western Electro-Therapeutic Association in 1921, is given in an appendix to the text proper. In this address are arguments for the adoption of physical methods of therapy by the general medical profession and the progress made by this form of therapy is reviewed.

A glossary, index and questionnaire complete the book.

Dental and Oral Radiography: A Textbook for Students and Practitioners of Dentistry. By James David McCoy, M.S., D.D.S., F.A.C.D., Professor of Orthodontia and Radiography, College of Dentistry, University of Southern California. Third Edition. Octavo pp. 197, illus. 116. St. Louis, C. V. Mosby Company, 1922. Cloth, \$3.00 net.

THIS, the third edition of this book, is put forth in as condensed a form as the author considered consistent with the object in view, namely, a text of interest primarily to the dental student.

The first chapters have to do with the physics and the early history of x-rays. The historical sketch, while given in a very brief and condensed form, is written in an unusually interesting manner.

The requisites of the dental x-ray laboratory and the technique of dental and oral radiography are then taken up. Intra-oral and extra-oral methods, proper tube and current conditions, correct exposure and development of x-ray plates and films are the specific topics discussed throughout the next 50 pages.

Drs. Baughman, Ebenreiter and C. W. Jones aided in the selection of the 60 films which illustrate 20 pages devoted to a discussion of the interpretation of dental and oral radiograms.

Indications for the use of the x-rays in the following conditions are given: general oral examinations, pericemental infections, root canal treatment, root resection, pyorrhea alveolaris and allied diseases, crown and bridge work, painful reflexes, oral surgery and orthodontia. Radiographic requirements for each of these conditions are given.

The author in his preface to this edition remarks that the overenthusiasm which marked the early history of dental and oral radiography has given way to more rational views. While dental and oral radiography is absolutely necessary in many instances, it is "but one important link in the chain of successful diagnosis."

Gonorrhea and Impotency: Modern Treatment. By Edwin W. Hirsch, S.B., M.D., with an Additional Lecture on Ultra-Violet Radiation by A. J. Pacini, M.D., 16 mo, pp. 172, illus. 27. The Solar Press, 209 So. State St., Chicago, 1922. Cloth, 3.50 net.

THIS book consists of nine lectures, the topics of which are (1) The Anatomy of the Urogenital Tract (2) Equipment; Solutions; Cleansing of Instruments. (3) Acute Anterior and Posterior Urethritis. Chronic Anterior and Posterior Urethritis. (4) Prophylaxis and Treatment of Acute Gonorrhea. (5) Treatment of Chronic Gonorrhea. (6) Complications of Gonorrhea. (7) Non-Specific Urethritis—Gonorrhea in the Female—Cystitis, Urinary Fever. (8) Impotence and Sterility. (9) Ultra-Violet Radiation.

The young practitioner, says the author, usually has only hazy and indefinite ideas upon the diagnosis and treatment of "the most important of human affections, venereal diseases." Text books do not contain the vital information needed in practice, and so the author has written this book out of his own successful experience in treating these diseases.

He has found physical agents to be of great value in the treatment of gonorrhea and its many complications. He discusses the etiology, pathology, symptoms and treatment of these various complications and where physical agents are advised detailed directions are given as to technique.

The last chapter, upon ultraviolet radiation in urology is a very compact little treatise written by A. J. Pacini, M. D.

There are two pages of colored illustrations, and a number of schematic diagrammatic drawings which were originated by Eugene F. Carey, M.D.





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